SUPPLY CHAIN MANAGEMENT:

PERCEPTIONS OF

REQUIREMENTS AND PERFORMANCE

IN EUROPEAN AUTOMOTIVE AFTERMARKET

SUPPLY CHAINS

Volume 1 of 2

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DECLARATION

The original data was collected during an EC research project ESPRIT no 2277, CIM for Multi Supplier Operations of which I was a key team member, along with Lin Fitzgerald and Derek Williams. I was actively involved in the data collection and the subsequent research. The

ESPRIT research used the data to generate a supply chain methodology and casebook.

This research went back to the original data in the form of transcribed interviews. The work represented here is my own and is separate to the ESPRIT project teams analysis.

SUMMARY

This dissertation is about supply chain management. Some authors have used the term to describe a strategic, inter-organisation issue, others authors to discuss an alternative organisational form to vertical integration. Much of the operations management literature uses the phrase to describe the planning and control of materials flow internally within a company or externally between companies.

This work develops a definition of supply chain management. The empirical research tests hypotheses relating to gaps in customers' and suppliers' perceptions of requirements and performance in supply chains, against a set of performance dimensions.

The hypotheses are tested in four automotive aftermarket supply chains, two of which are in Spain and two in the UK. All four chains have similar structures and include a manufacturer, an area distributor, a local distributor and ten installers, or garages.

Qualitative and quantitative analysis show significant differences between different types of gaps in perceptions; suppliers in the chains do not recognise the degree of customer dissatisfaction in existence. A positive correlation is shown to exist between the amount of misperception in the chains about performance and the amount of customer dissatisfaction. It is also shown this customers are more dissatisfied with some performance dimensions than others.

In these supply chains, customer dissatisfaction and misperception of performance both significantly increase upstream i.e. downstream customers are more satisfied and there is less misperception in downstream relationships about performance levels. This effect is compared to the industrial dynamics "Forrester Effect".

The work develops the concept of supply chain management into a broader, holistic concept of inter-organisation operations management. It contributes to operations management by (i) developing the concept of supply chain management (ii) improving knowledge about relationships in supply chains (iii) identifying the significant role of performance (iv) improving knowledge about the implication of position in a supply chain (v) integrating related literatures, notably service management, purchasing, industrial dynamics and logistics.

CHAPTER 1 - INTRODUCTION

BACKGROUND

The subject of supply chain management has only received serious recognition, using this term, since the mid 1980s; it is therefore a new area.

The coverage of work on supply chain management to date is patchy and unconnected. Recently it has been termed an alternative form of market organisation to vertical integration (Ellram 1991b, Christopher 1992), a set of techniques for dealing with planning and control of total materials flow from suppliers through end users (Jones & Riley 1985), a network of organisations (Christopher 1992), an extension of the logic of logistics (Christopher 1992), a connected series of planning and material control activities from suppliers to customer (Stevens 1989), part of networking (Lamming, 1993) and managing the entire chain of supply from raw material through to end customer (Jones (Harland) 1989).

The challenges facing research in this area are this newness of the subject, the lack of clear definitional constructs and the lack of conceptual frameworks.

Given these challenges, it is necessary for this research to trawl various literatures to establish a definition of supply chain management, as well as to understand work to date in the subject area. The breadth of the definitions

provided earlier demonstrates the necessity of searching various literatures covering strategic and structural issues as well as infrastructural, planning and control oriented work.

OBJECTIVE OF THE RESEARCH

It is the objective of this research to gain an understanding of supply chains to enable a potential supply chain manager to co-ordinate the various organisations in that supply chain to better serve the end customer. It should not be implied that a supply chain manager is a job title for an individual, but rather an influential firm or **key player** in a supply chain. However, the views in the literature on what this "understanding" should be and how it might be gained are many and varied. The work therefore attempts to draw from these literatures and synthesize this means of understanding.

The objective of the empirical study is to provide a clearer understanding of requirements and performance in supply chains from the end customer, back up through distribution businesses to the manufacturer, to identify levels of satisfaction / dissatisfaction. There is support in the service management, consumer behaviour and general business literatures for understanding customers' expectations and perceptions of performance, rather than any "actual" or "real" performance. Therefore, a behavioural view of perceptions of the different parties

involved in the relationships in the supply chains is examined to derive this view of satisfaction / dissatisfaction. The purpose of this is to identify any patterns of dissatisfaction and to identify linkages with requirements and performance.

An underlying purpose of this research is to add to the limited body of knowledge on supply chain management, particularly by uniquely drawing together the various, diverse pieces of work to date to develop a definition. Further to provide tools and concepts which will help practitioners examine and better understand the supply chains within which they operate.

THE STRUCTURE OF THE DISSERTATION

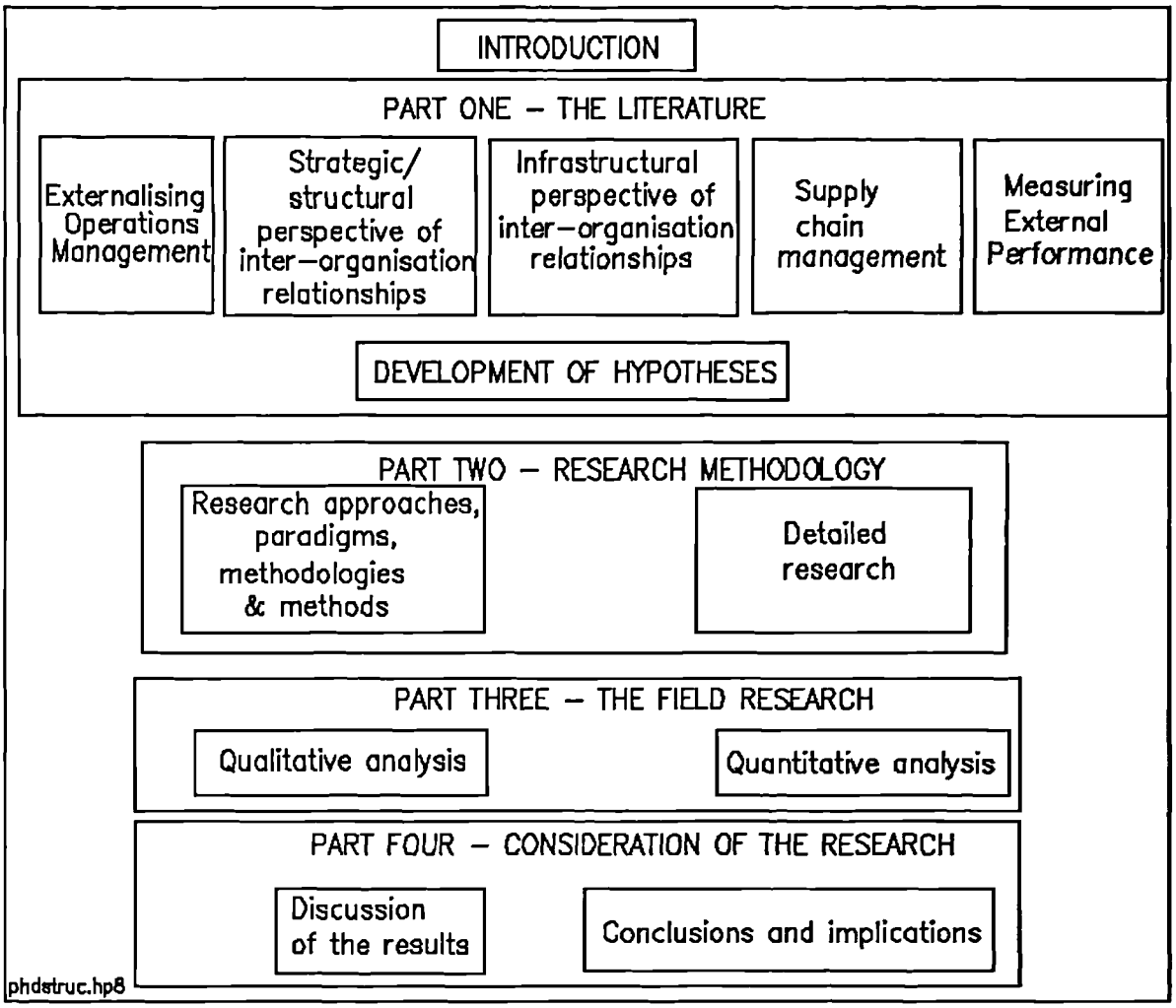

Figure 1.1: Structure of the dissertation

The above figure shows the structure of the chapters that comprise this dissertation. Following is a brief overview of each of the chapter objectives.

PART ONE - THE LITERATURE

CHAPTER 2 - EXTERNALISING OPERATIONS MANAGEMENT

The objective of this chapter is to trace the origins and development of Operations Management to highlight why, relatively recently, there has been a shift in emphasis in the subject, away from internally oriented aspect to a more external orientation. The development of ideas on vertical integration, the commercial supply chain and performance dimensions are explored as they are relevant to this work on supply chain performance.

CHAPTER 3 - STRATEGIC AND STRUCTURAL PERSPECTIVE OF INTER-ORGANISATION RELATIONSHIPS

This chapter considers literature examining the value chain, different organisational forms or types of relationship and the structure of channels and networks. To do this it necessarily draws on strategic management, industrial economics, operations strategy, information systems strategy, marketing strategy and purchasing strategy literatures.

CHAPTER 4 - INFRASTRUCTURAL PERSPECTIVE OF INTER-ORGANISATION RELATIONSHIPS

The objective of this chapter is to consider the nature of day-to-day connections between organisations. To do this the **interaction approach** (Hakansson, 1982) of the

Industrial Marketing and Purchasing Group is used to structure the discussion, dividing consideration of the literatures into that relating to short term exchange episodes and long term relationships. The logistics, industrial dynamics, purchasing, marketing and operations management literatures are reviewed to identify the nature of short term exchange. Examination of long term relationships is made by reviewing the business strategy, marketing strategy, operations strategy and information systems strategy literatures.

CHAPTER 5 - SUPPLY CHAIN MANAGEMENT

This chapter draws on and develops the literatures examined in the previous 3 chapters and specifically discusses work using the term "supply chain management" to review the use of the term. It endeavours to develop a definition of supply chain management for the research which captures the strategic, structural and infrastructural aspects of managing inter-organisation relationships.

CHAPTER 6 - MEASURING EXTERNAL PERFORMANCE

This research is about supply chain management and specifically about supply chain performance. This chapter reviews external performance, identifying the increasing importance of operational, as opposed to financial, performance measurement. Hard and soft dimensions of performance are discussed, using the operations strategy, service management and purchasing literatures. The

importance of viewing performance in the context of the relationship of expectations, perceived performance and satisfaction is discussed. As the empirical research is to involve measuring performance in supply chains, available models for performance measurement are discussed.

CHAPTER 7 - DEVELOPMENT OF HYPOTHESES

This chapter intends to draw out research issues from the literature and to develop a set of hypotheses for testing in the field.

PART TWO - RESEARCH METHODOLOGY

CHAPTER 8 - RESEARCH APPROACHES, PARADIGMS, METHODOLOGIES AND METHODS

Having developed hypotheses in the previous chapter, this chapter reviews research theory to identify an appropriate methodology for this research. A range of research approaches, paradigms, methodological foundations and methods are considered. Guidance is sought from the operations management literature on reasonable combinations of these to carry out research of this nature.

CHAPTER 9 - DETAILED RESEARCH

The objective of this chapter is to describe the design of the research to test the hypotheses developed in chapter 7. This involves understanding the research

process, designing the research instrument and the research sample.

PART THREE - FIELD RESEARCH

CHAPTER 10 - QUALITATIVE ANALYSIS

This chapter presents the results of the qualitative analysis of the data collected in the four supply chains studied in the field work. Details of qualitative comparisons are provided here.

CHAPTER 11 - QUANTITATIVE ANALYSIS

The objective of this chapter is to provide the results of further analysis of the data using quantitative methods.

PART FOUR - CONSIDERATION OF THE RESEARCH

CHAPTER 12 - DISCUSSION OF THE RESULTS

It is the intention of this chapter to discuss the results in the context of the research hypotheses, identifying whether the analysis of the field research has been able to prove them.

CHAPTER 13 - CONCLUSIONS AND IMPLICATIONS FOR THEORY

This chapter reflects on the methodology, the chosen sample for the field work and the analysis performed. It also reflects on the implications of the results for the

theory of supply chain management and operations management.

CHAPTER 14 - IMPLICATIONS FOR OPERATIONS MANAGERS

This final chapter considers how the work should be viewed by practising Operations Managers and how it could be used to improve their performance.

CHAPTER 2 - EXTERNALISING OPERATIONS MANAGEMENT

SUMMARY

This chapter traces the origins and development of Operations Management to highlight that a shift in emphasis has occurred, away from an internal focus to a more externally oriented approach. This, coupled with the development of manufacturing and operations strategy, has awakened Operations Management authors and researchers to the need to (i) be more customer oriented (ii) be more strategically oriented (iii) think beyond the traditional operations management boundary of the firm.

Firstly, the development of Operations Management from factory management, to production management, to modern production / operations management to operations strategy is traced. The following concepts from operations strategy are discussed (i) vertical integration and sourcing (ii) the concept of a commercial supply chain (iii) the set of decisions which constitute a strategy and (iv) performance dimensions. A chronology highlighting key concepts and contributors is provided.

Key points are drawn from the literature which are used to (i) highlight other bodies of literature to be reviewed to examine inter-organisational issues and (ii) to develop a matrix against which literature contributions can be mapped to identify coverage and gaps in the literature.

INTRODUCTION

The subject of this dissertation is Supply Chain Management and in particular supply chain performance. The subject is new and not yet clearly defined or described; whilst a definition of Supply Chain Management is developed and clarified in Chapter 5, it is viewed initially as the management of inter-organisation relationships.

The objective of this chapter is to trace the development of the subject of Operations Management to highlight when an inter-organisation perspective emerged and what form this perspective took.

Whilst Operations Management has only been taught relatively recently in business schools as an academic subject in its own right, its roots can be traced back to the Industrial Revolution. It is important to understand the subject's roots and its development since that time to help identify when and why shifts in perspective occurred.

The first section in this chapter briefly describes those roots and traces that development, highlighting significant contributions to the subject which have lead to the nature of operations management as we understand it today.

The second section of the chapter summarises these developments, highlighting significant steps forward that impact on the study of Inter-Organisation Operations.

Because of the limited amount of work to date on Supply Chain Management, there is a shortage of conceptual frameworks available to judge other work by. Therefore the third section of this chapter develops such a framework to (i) locate other work and (ii) identify coverage and gaps in the literature. A direction for a broader literature search is provided.

Firstly, it is useful to understand how and when the perspective of operations management changed from intra-organisation to inter-organisation. The next section briefly traces how Operations Management developed in this way.

THE DEVELOPMENT OF OPERATIONS MANAGEMENT

Factory Management

In the "Genealogy of Operations Management" Meredith and Amoako-Gyampah (1990) traced the roots of operations management back to the origination of factories at the time of the Industrial Revolution when it was termed **"factory management".** The Industrial Revolution saw a significant change in production because of (i) the invention of machinery which began replacing people as resources in the production process and (ii) the division of labour into planned and organised tasks (Adam Smith,

1776). These 2 major changes caused output to increase significantly.

Babbage (1832) developed the ideas of division of labour by skill, the assignment of jobs by skill and the basics of time study (Adam and Ebert, 1982). These were further developed by formation of motion study by Gilbreth (1900). However, the most notable contribution on the development of time and work study was made by Frederick Taylor (published in 1911) in work that was termed **Scientific Management.**

The principles of scientific management were that scientific laws existed which determined how much a man could produce; if managers could understand and apply these laws, they could gain control over production.

The principles of the division of labour and scientific management coupled with the introduction of the first moving assembly line for the manufacture of Ford cars in 1913 (Ford 1926) were the foundations of what became known as production management.

Production Management

Production management replaced factory management as the more widely accepted term from the 1930s to the 1950s. As Taylor's scientific management became more widely known, economic efficiency became the core focus for the study of manufacturing organisations. Work measurement and pay

incentives were applied to management situations. The Hawthorne studies in the late 1930s saw psychologists and sociologists also joining in the study of people at work.

In addition to the people centred studies there were also developments taking place in the early 1930s in the use of statistics and sampling in the control of quality.

World War II saw the most rapid application of and development of concepts in the area of production management. At this time Operations Research techniques were applied to military problems; new terms and concepts such as **logistics** were born. These OR approaches aimed to optimise efficiency in inventory management, project management and work scheduling. However it has since been pointed out (e.g. by Buffa, 1976) that these techniques often optimised sub-systems rather than the system as a whole.

The "systems thinking" introduced originally by von Bertalanffy (1950) in the area of physics and biology became adopted by management thinkers. Rather than optimising sub-parts of systems, systems thinking treated management holistically. Application of systems theory is evident in production management (e.g. Lockyer, 1962) and in related areas (e.g. Forrester, 1961, in industrial dynamics).

Meredith and Amoako-Gyampah (1990) expressed the view that:

> **"Modern operations did not come into its own until probably the late 1950s"**

and it is the embodiment of this broader, systems approach which appears to have given it birth.

Modern Production / Operations Management

From the 1960s onwards there have been many standard texts on Operations Management all of which contain broadly the same topics including production planning and control, facilities design, inventory management, capacity management and quality management (see for example Buffa 1969 and Wild 1971).

There is general acceptance that core to the concepts of modern production / operations management is the transformation model i.e. production / operations management is seen to be concerned with the task of taking input resources of labour, plant and machinery, materials and information and managing their transformation into goods and services. This model is shown below in figure 2.1.

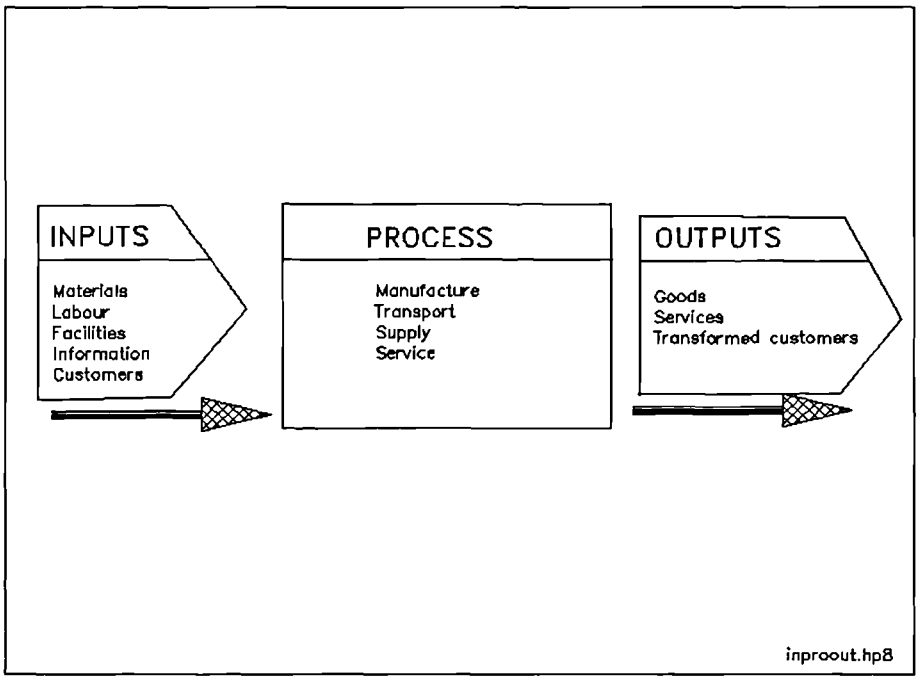

Figure 2.1: Production / Operations Management Transformation Model

For example, Buffa (1976) defined operations management as the management of productive systems or mechanisms for creating goods and services from inputs of materials, labour, machines, facilities, energy, information and technology.

Most early texts in the subject concentrated on the tasks performed by the production manager (Meredith et al 1989); these tasks were largely internally oriented. Mayer (1962) deliberately chose to omit externally oriented decision areas, such as plant location, from his text on production management, expressing the view that the production manager would only play a minor role in such decisions.

Some operations management general texts have included discussion on external issues for some time. For example, Wild (1971) had a chapter on purchasing and supply, but this was the exception rather than the rule. It is only relatively recently that Operations Management has begun to consider externally oriented topics. Some recent Operations Management texts such as Schmenner (1990), Meredith (1992) and Schonberger and Knod (1988) have chapters on logistics, purchasing and materials management and procurement.

Operations management has undergone this shift towards externalisation during the last 15 years, but still external issues are not yet adequately addressed at the strategic level. To clarify this, a brief summary of the operations strategy literature's view of external issues is provided.

Recognition in Operations Strategy of External Issues

The Manufacturing Strategy concept was first formed by Wickham Skinner in 1969 in a ground breaking paper highlighting the strategic significance of the manufacturing operation in business strategy. Skinner described manufacturing as **"the missing link"** in the formulation of corporate strategy; he articulated manufacturing strategy in terms of a number of decision areas related to:

- plant & equipment
- production planning and control
- labour and staffing
- product design / engineering
- organisation & management

No mention was made of externally oriented decisions relating to dealing with customers or suppliers.

In addition to defining this set of decisions which constituted a manufacturing strategy, Skinner (1969) also articulated operations inability to be good at everything - demands for productivity, time, quality and customer service could not all be satisfied. They forced sacrifice and compromise and were therefore **"trade-offs"**

Skinner (1974) also made a substantial contribution to the field of operations management by providing the concept of **"focus"** i.e. paying attention to a more limited range of products or processes to become better at fewer things.

Steven Wheelwright (1978, 1984b) developed the theme of trade-offs, proposing four competitive priorities of:

- Cost
- Quality
- Dependability (products work reliably, they are delivered on time - the strategy emphasises "peace of mind"

- Flexibility (product flexibility and volume flexibility)

Wheelwright (1978) stated:

> **"the basic problem is that most decisions, particularly those in manufacturing, require trade-offs among various criteria. All too often the trade-offs...are internally inconsistent...to corporate strategy".**

Miller (1983) described the trade-offs made in manufacturing in terms of a plant's missions of:

- low unit cost
- high quality
- high service level
- wide product line
- customer service
- product innovation
- responsiveness to change

Miller highlighted that giving a low unit cost plant a high quality assignment is likely initially to lead to a lower quality product than required and, if quality is improved, to a higher unit cost.

So, manufacturing strategists were forming the view that an operation could not be good at everything and should recognise the trade-offs it had to make. However, the literature was evolving and evidence of questioning

.

trade-offs emerged (Wheelwright, 1981). Quality gurus reported that Japanese manufacturers were good at everything, therefore low cost need not be traded-off for better quality (e.g. Philip Crosby's **"Quality is Free"** 1979).

Dimensions of performance or competitive priorities still featured in Hayes & Wheelwright (1984) in **"Restoring our Competitive Edge: Competing Through Manufacturing"**. Here they provided an organising framework grouping manufacturing decisions into categories to help identify and plan a firm's manufacturing strategy, stating it is the:

> **"collective pattern of these decisions that determines the strategic capabilities of a manufacturing organisation".**

Their categorisation and definitions are provided below in table 1.1. Hayes & Wheelwright defined the first four of these categories as **"structural"** because of **"their long-term impact, the difficulty of reversing or undoing them once they are in place, and the fact that a substantial capital investment is required to alter or extend them"**. The last four categories they termed **"tactical"** and **"infrastructural"** but chose to include them because **"we have found that the cumulative impact can be just as difficult and costly to change (if not more so) than those belonging to the first four categories".**

Category	Definition
Capacity	Amount, timing and type
Facilities	Size, location, specialisation
Technology	Equipment, automation, linkages
Vertical integration and sourcing	Direction, extent and balance
Workforce	Skill level, wage policies, employment security
Quality	Defect prevention, monitoring, intervention
Production planning / materials control	Sourcing policies, centralisation, decision rules
Organisation	Structure, control / reward systems, role of staff groups

Table 1.1: Manufacturing Strategy Decision Categories
Source Hayes & Wheelwright (1984)

Reinforcing their earlier point about the combination of these decisions representing strategic capability they further developed this by commenting:

> **"It is this pattern of structural and infrastructural decisions that constitutes the "manufacturing strategy" of a business unit"**

One of the decision areas which is externally oriented is that of **"vertical integration and sourcing".**

Vertical Integration and Sourcing

Hayes & Wheelwright (1984) discussed how a marketing function may choose **"product position"** as a way of steering the company's products to provide competitive

advantage, whereas manufacturing may be able to provide advantage by steering **"process position"** - making **"vertical integration and sourcing decisions"** which included fundamental concerns such as:

"1. What boundaries should a firm establish over its activities?
2. How should it construct its relationships with other firms - suppliers, distributors and customers - "outside" its boundaries?
3. Under what circumstances should it change its boundaries or these relationships, and what will be the effect on its competitive position?"

They used the term **"span of operations"** to describe the breadth of a firm's boundary. It was identified that a firm is usually one link in a larger chain of links which they termed the **"commercial chain".**

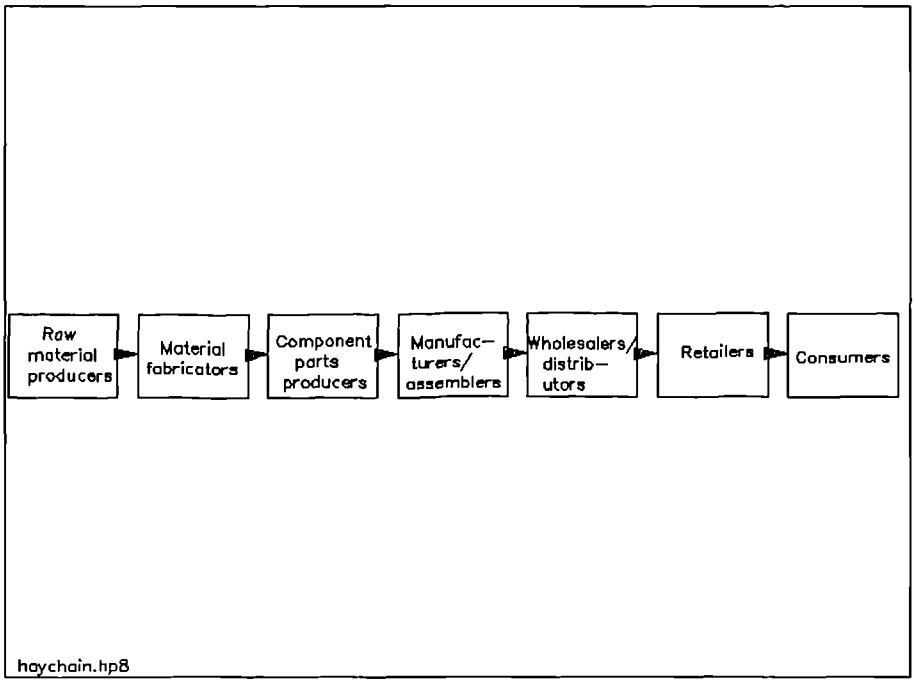

Figure 2.2: **Commercial Chain** Source Hayes & Wheelwright 1984

Hayes & Wheelwright described how a typical small manufacturer buys parts from independent suppliers, assembles them and sells its products to independent wholesalers. They identified that an actual commercial chain is more complex. Most manufacturers have a number of suppliers and distribution is similarly complex; however, the simple linear commercial chain helped clarify their concepts relating to vertical integration and sourcing.

The core of their concern in this discussion was focussed on whether to take over suppliers or customers or not. They considered:

"(1) **The direction of such expansion"**

- downstream, or forward integration to increase control over markets, or upstream, backwards integration increase control over suppliers

"(2) **The extent of the process span desired"**

- how far forward or backward to integrate

"(3) **The balance among the resulting vertically linked activities"**

- how to balance the capacities of each stage in the chain; whether to have "outside" customers and suppliers or whether 100% of an owned firm's output is used by the next owned link/s.

Hayes & Wheelwright discussed vertical integration as a way of increasing the value-added component of a firm's total revenue, enabling it to **"exercise greater control over its costs, final selling prices and ultimate profitability"**. This evoked the concept of the **"value chain"**.

So the manufacturing strategists had moved operations management forward substantially by:

(i) providing a set of decisions which constituted a manufacturing strategy

(ii) providing an external orientation for that strategy

(iii) identifying a set of performance dimensions upon which a manufacturing operation could help a company to compete

(iv) conceptualising a commercial chain

Up to this time, the literature had not provided a clear mechanism or process for a manufacturing organisation to integrate these in a process of strategy formulation. Terry Hill (1985) provided a process to link manufacturing strategy to market needs and business strategy.

A process for linking performance dimensions to strategy

Hill (1985) articulated performance dimensions as those that won orders (order-winning criteria) or allowed the business to compete for orders (qualifying criteria). Order-winning and qualifying criteria were listed as:

- price
- product quality and reliability
- delivery speed
- delivery reliability
- responsiveness to demand increases
- technical liaison and support
- meeting a launch date
- being an existing supplier
- product and colour range

Hill identified that the relative importance of these criteria would differ between companies and possibly between products within companies; also, that they were likely to change over time.

Hill's key contribution was a manufacturing strategy process which held these order-winning and qualifying criteria as pivotal in the formulation of manufacturing strategy.

CORPORATE OBJECTIVES	MARKETING STRATEGY	HOW DO PRODUCTS WIN ORDERS IN THE MARKET PLACE?	MANUFACTURING STRATEGY	
			PROCESS CHOICE	INFRASTRUCTURE
Growth Survival Profit Return on investment Other financial measures	Product markets and segments Range Mix Volumes Standardisation v. customisation Level of innovation	Price Quality Delivery speed reliability Demand increases Colour range Product range Design leadership Technical support being supplied	Choice of alternative processes Trade-offs embodied in the process choice Process positioning Capacity size timing location Role of inventory in the process configuration	Function support Manufacturing planning and control systems Quality assurance and control Manufacturing systems engineering Clerical procedures Payment systems Work structuring Organisational structure

Hillms.hp8

Figure 2.3: Framework for Reflecting Manufacturing Strategy Issues in Corporate Decisions
Source Hill 1985

As can be seen in the above framework, a structural, infrastructural split to manufacturing strategy decision areas was adopted using a similar approach to Hayes & Wheelwright (1984), albeit with slightly different terminology. Hill labelled structure as process choice

and infrastructure as the non-process features within production.

Chronologically, the next significant piece of work in the Operations Strategy literature considering external issues was the development of a four stage model by Wheelwright & Hayes (1985).

Development of a four stage model of externalisation

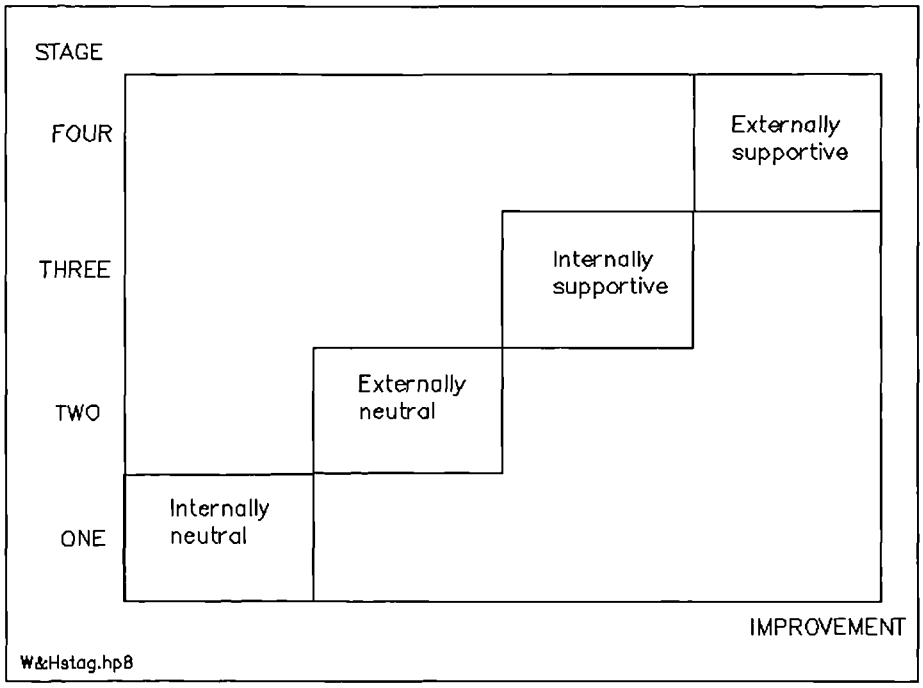

Figure 2.4: **Four stage model** Source Wheelwright and Hayes (1985)

This model showed the development of an operation from being internally focused to being externally focused to the point where, not only can it support the externally oriented strategy of a business (at stage 3) it may also progress to being able to provide the external direction for the business (at stage 4). Wheelwright & Hayes

proposed that most operations would have to pass through these phases in sequence to become a world class manufacturer, or stage 4 company. i.e. the internal problems have to be solved first.

In 1988 Hayes, Wheelwright and Clark changed their key decision areas in manufacturing to the list provided below in table 1.2:

STRUCTURE	
1.	The amount of total production capacity to provide
2.	How this capacity should be broken up into specific production facilities (how they should be specialised and where they should be located)
3.	What kind of production equipment and systems to provide those facilities with
4.	Which materials, systems, and services should be produced internally and which should be sourced from outside the organisation (and what kind of relationships would be established with outside suppliers).
INFRASTRUCTURE	
5.	Human resource policies and practices, including management selection and training policies
6.	Quality assurance and systems
7.	Production planning and inventory control systems
8.	New product development processes
9.	Performance measurement and reward systems, including capital allocation systems
10.	Organisational structure and design

Table 1.2: **Set of structural and infrastructural decisions** Source Hayes, Wheelwright and Clark (1988)

To briefly reflect at this point on the key decision areas in manufacturing strategy identified by Skinner,

Hayes and Wheelwright and Hayes, Wheelwright and Clark, the following table summarises the evolution of the concept.

SKINNER (1974)	HAYES & WHEELWRIGHT (1984)	HAYES, WHEELWRIGHT & CLARK (1988)
Plant and equipment	Capacity	Capacity
	Facilities	Facilities
	Technology	Production equipment and systems
	Vertical integration	Internal / external sourcing
Labour and staffing	Workforce	Human resource policies
	Quality	Quality systems
Production planning and control	Production planning & control	Production planning
Product design / engineering		New product development
Organisation and management	Organisation	Organisation
		Performance measurement systems

Table 1.3: Evolution of framework of key operations decision areas

As can be seen in table 1.3, external sourcing became a key decision area in formulation of strategy. However, little had been done to identify how these external sourcing decisions could be implemented, other than by

vertical integration. Hayes & Wheelwright (1984) defined alternatives to vertical integration as:

- Holding inventory to avoid being squeezed and controlled by suppliers in times of shortage

- Modified vendor relations which are non contractual, longer term relationships with suppliers

- Long term contracts, joint ventures, minority equity investments and licensing arrangements (a large array of options to which they afforded two small paragraphs)

- Investment integration, as opposed to operating integration e.g. purchasing tools and dies at suppliers plants

but spent a total of just over three sides of text on the subject in a book of 427 pages. In 1988 they spent three sides discussing **"comakership"** as the alternative to either vertical integration or arms length adversarial trading, again a short discussion in a text of 429 pages.

Since 1988 the work in operations strategy has been mixed in its contribution to knowledge on externalised operations. From Harvard, David Garvin's text **"Operations Strategy"** (1992) did not address upstream supply or downstream distribution, focusing still on internal

issues. The only recognition in this work of multi-plant situations was one of a company wholly owning different sites.

Terry Hill (1989) in **"Manufacturing Strategy"** further developed the term **"process positioning"** for a chapter on:

> **"the width of a firm's internal span of process, the degree and direction of vertical integration alternatives, and its links and relationships with suppliers, distributors and customers".**

Hill offered five alternatives to ownership:

- Joint ventures - separate entities with two or more firms sponsoring often the application of technology and research

- Non-equity based collaboration - longer term co-operation without the formal ownership structure of a joint venture

- Long term contracts with suppliers to provide **"added predictability and increased assurance, which helps when establishing long term plans"**

- Customer-vendor relations (Hill's definition here is not clear as to how it is distinct from collaboration, but appears to relate to a formation of a trust relationship which does

not necessarily involve collaboration on a new or particular project)

- Just-in-Time Production - Hill highlights this as a special case requiring **"effective co-operation and co-ordination between the various parts of the process"**, the process referring to just-in-time material supply, sub-assembly, assembly and delivery.

However, again only five sides of text are devoted to how these external arrangements might be made.

A revolutionary text appeared in 1990 which has since dramatically reshaped the Operations perspective of external relations and their significance. **"The Machine the Changed the World"** by Womack, Jones and Roos (1990) came out of the work of the International Motor Vehicle Program (IMVP) at MIT and established the phrases **"Lean Production"** and **"Lean Supply"** in Operations Management vocabulary. Their work explored the differences between mass production (the typical Western mode of production) and lean production (the Japanese mode of production) in the automotive industry.

Whilst not written as an Operations Strategy text, "The Machine the Changed the World" should rightly be considered here as a major work on Operations Strategy. In this text there are two chapters dealing solely with

external aspects of operations - one titled **"Co-ordinating the supply chain"**, the other **"Dealing with customers"**, a total of 64 pages dedicated to external issues.

Womack et al's (1990) work was contributed to by many people involved in the programme, including authors such as Richard Lamming and Toshihiro Nishiguchi who have each generated their own bodies of work - see, for example, Lamming (1987a, 1987b, 1989, 1990, 1993) and Nishiguchi (1987, 1994). The individual contributions as well as the total work warrant significant study by this research and their fuller examination is made in the subsequent two chapters and, indeed, throughout this work. However, in this chronology of literature development, some key points about their work will be made here.

For the first time in the operations strategy literature, significant attention was paid to:

- organisational modes other than vertical integration
- the concept of a network of suppliers, suppliers' suppliers and so on upstream
- the concept of a network of customers, customers' customers and so on downstream
- the significance of the ultimate consumer (a relatively ignored term in operations management)

- how relationships can be managed
- performance implications of these external arrangements
- the connection with work on channel management
- the significance of information technologies in managing these relations

More recently, Slack (1991) devoted a chapter in **"The Manufacturing Advantage"** to discussing **"Managing Supply Networks"** which was based largely on some of the work performed in the IMVP program and since by Richard Lamming (1987b, 1990) and work performed in SERC and ESPRIT funded research projects by Christine Harland (Jones) (1990b, 1990c)

Slack discussed:

> **"Materials, parts, assemblies, information, ideas and money flow through customer / supplier links from raw material processors, minor and major component suppliers, final product and original equipment manufacturers, distribution systems, after-market operators, through to end customers. Each operation is just one link in a complex network."**

Like Womack et al (1990) Slack considered the concepts of:

- the network
- relationships

- end customers
- an entire network to end customers including downstream distribution as well as upstream supply
- the need to understand if not manage the network

Since then more specialist publications have appeared in the area of supply chain management to further the discussion. It is pre-dominantly this evolutionary path of literature which has prompted this piece of research to explore in depth the concept of supply chain management.

CHRONOLOGY OF THE LITERATURE

The Operations Management literature has evolved from an internal, tactical, oriented literature to becoming a more externally aware, strategic oriented literature. The strategic orientation has only been evident since 1969 and as a substantial body of work since the mid 1980s. The external orientation has only been evident as a substantial body of work since 1990. The table below summarises this chronological development, with key contributions identified.

Year	Contribution	Key contributor
1776	Specialisation of labour	Adam Smith
1832	Basics of time study	Charles Babbage
1900	Motion study	Frank Gilbreth
1911	Scientific management	Frederick Taylor

1913	Assembly line for car production	Henry Ford (pub 1926)
1940	Operations research applications to WWII	e.g. Blacket
1946	Digital computer	Mauchly, Eckert
1950	Systems thinking	von Bertalanffy
1960 onwards	Application of OR to OM	e.g. Buffa, Holt et al
1969	Manufacturing strategy concept	Wickham Skinner
1974	Concept of focus	Wickham Skinner
1984	Pattern of manufacturing decisions, commercial chain and process position	Hayes and Wheelwright
1985	4 stage model	Wheelwright & Hayes
1988	Revision of pattern of manufacturing decisions	Hayes, Wheelwright & Clark
1985	Manufacturing strategy process	Terry Hill
1989	Development of process positioning concept	Terry Hill
1990	Lean production and lean supply concept	Womack, Jones & Roos
1991	Managing supply networks as part of manufacturing strategy	Nigel Slack

Table 1.4: Chronology of Development of the externalisation of the Operations Management and Operations Strategy literatures

CONCLUSIONS

This section will draw out and conclude key points from the literature reviewed above to (i) identify other relevant literatures to search and (ii) develop a framework to locate and relate these literature contributions to supply chain management.

Identification of other relevant literatures

Key points have emerged from the prior discussion of the evolution of operations management which point to other relevant literatures. These are summarised in bold and discussed below:

- **The increasing importance for operations to consider logistics and procurement (see Schmenner 1990, Meredith 1992, Schonberger and Knod 1988)**

- **The connection with work on channel management (Womack et al 1990)**

The literature camps of logistics, procurement (or purchasing and supply), channel management and operations have, in the main, been historically separate with logistics and channel management authors pre-dominantly originating from marketing, purchasing from the traditional academic area of purchasing and operations, in the main, from production and engineering. It is appropriate that this research searches these literatures.

- **The significance of ownership of the chain or the type of relationship, if not ownership, between parties in the chain (Hayes and Wheelwright 1984, Hill 1989)**

Ownership or type of relationship between parties has been studied mainly by the industrial economists, from a market organisation perspective, and by strategic management. Therefore each of these literature areas should be searched to identify relevant knowledge from these perspectives.

- **The significance of the concept of value-added and the value chain (Hayes and Wheelwright, 1984)**

The value chain and value-added concept is of concern particularly to business strategists and has been used as a tool by cost accountants.

This thesis is about a strategic aspect of operations management and therefore the business strategy literature view will be sought. The accounting and finance literature will not be reviewed.

- **The dynamics of chain operations - the "accelerator effect" (Hayes & Wheelwright 1984).**

This evokes the concept of **"industrial dynamics"** which has its own body of literature; therefore it is necessary to review this literature for work which considers inter-organisation operations.

- **The significance of studying networks in operations (Womack et al 1990, Slack 1991)**

The study of networks appears to be largely in the areas of industrial marketing and purchasing; it is necessary to search these literatures for relevant concepts and research in inter-organisation operations.

- **The increasing importance of operations viewing performance in the context of external performance (Wheelwright & Hayes 1985)**

- **The significance of dimensions of performance / competitive priorities / trade-offs / order-winning and qualifying criteria (Skinner 1969, Wheelwright 1978, Miller 1983, Hayes & Wheelwright 1984, Hill 1985 and 1989 and Slack 1991)**

The performance literature is very broad, spanning most business academic literatures. The particular parts of this literature which appear relevant are those which address performance in more operational, externally oriented terms rather than in financial and / or inwardly

oriented terms, because of the nature of this piece of research.

- **The significance of information technologies in managing network relations (Womack et al 1990)**

The operations management area has become increasingly aware of the significance of information technologies. Within company boundaries, operations have become entwined with concepts and systems such as MRP I (Materials Requirements Planning), MRP II (Manufacturing Resource Planning) and CIM (Computer Integrated Manufacturing).

Therefore the application area of information technology will be considered, where relevant, but this research will not examine the technologies themselves.

As a result of using these key points from the literature the following literature path was derived for this research.

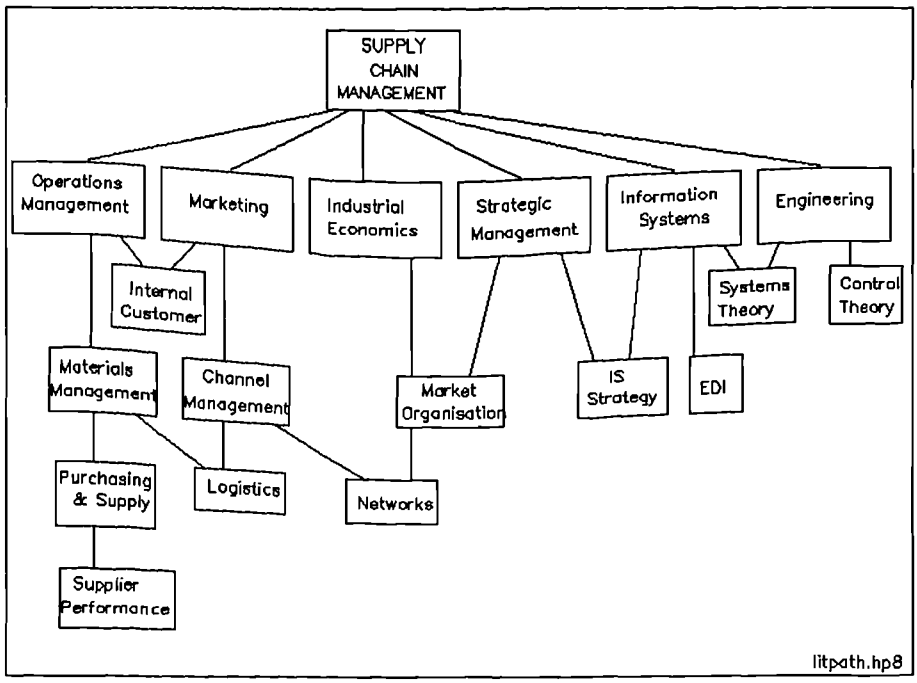

Figure 2.5: Literature search path for this research

Whilst it was acknowledged that literature existed in the Accounting and Finance area relating to Supply Chain Management, predominantly about added value and transfer pricing, it was decided not to explore this area. For two reasons:

(i) The focus of interest for this research was not related to accounting and finance issues in managing supply chains and

(ii) A realistic boundary had to be drawn around the research

The other area of business literature not explored in any depth was that of human resource management. It was

acknowledged that there are significant human resource implications of managing across company boundaries; authors including Cole (1985), Pucik (1988) and Nonaka and Johansson (1985) have identified the importance of organisational learning in collaborative relationships. However, this thesis did not set out to investigate the HRM implications of managing supply chains; therefore this literature was not investigated in detail.

Derivation of a framework for locating work

To help derive this framework, two further key points can be concluded from the literature:

- **The significance of a commercial chain (Hayes and Wheelwright 1984)**

- **The significance of the span of operations or the process position (Hayes & Wheelwright 1984, and Hill 1989) and the position within the chain (Hayes & Wheelwright, 1984)**

This piece of work is about managing the supply chain as opposed to managing just one operation. Therefore, when reviewing the literature it should be asked how much of the entire chain from raw materials extraction to ultimate consumer is being referred to when authors use the term Supply Chain Management? Hayes & Wheelwright (1984) suggest that position in the supply chain has implications; therefore, any review of work in supply

chains should clearly understand which part of the chain the work was performed in to see if this position context may (i) effect the author's perspective and (ii) effect any subsequent interpretation of that work.

Therefore, a simple map of a supply chain will be used in this dissertation to identify how much of the chain researchers are considering. This simple chain is based on what Hayes & Wheelwright referred to as a **"commercial chain".**

Some additions can usefully be made regarding the downstream part of the chain i.e. that closer to the consumer. Christopher (1992) identified more downstream distribution links than Hayes & Wheelwright. This is shown below in figure 2.6.

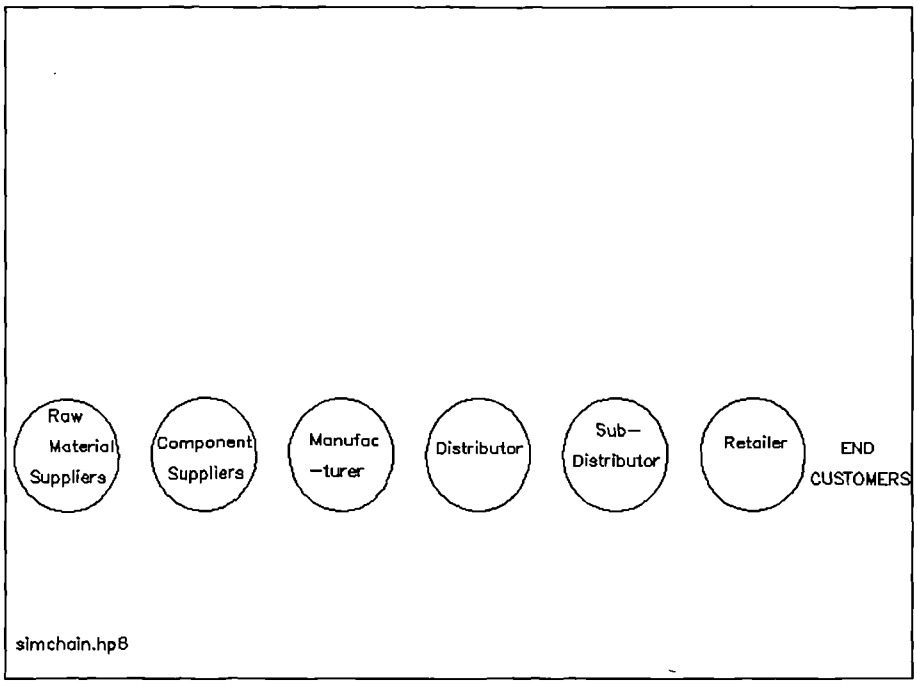

Figure 2.6: Supply Chain Structure for the Literature Review

A further key point derived from the manufacturing strategy literature is:

- **The significance of the set of decisions which constitute a manufacturing strategy (Skinner 1969, Hayes & Wheelwright 1984, Hayes, Wheelwright & Clark 1988 and the distinction between structural and infrastructural decisions (Hayes & Wheelwright 1984 and Hill 1985 and 1989)**

As has been demonstrated, the operations strategy concept is relatively new with little recognition of supply chain decisions. It is therefore useful to identify, when surveying the literature, which decision areas have been addressed. Therefore, Hayes, Wheelwright & Clark's (1988) categorisation will be used for this purpose.

By combining the simple supply chain shown above in figure 2.6 with the set of decision areas, a two dimensional matrix can be formed.

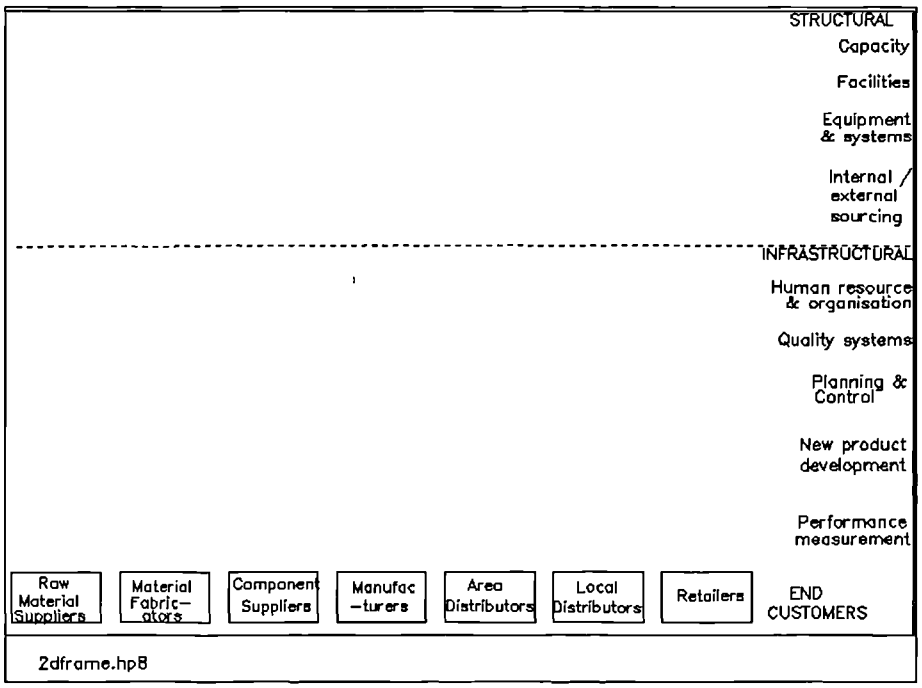

Figure 2.7: Two dimensional framework for categorising literature

This matrix will be used in the subsequent literature chapters to summarise the location of literature in terms of breadth of coverage of the supply chain and depth of coverage of the decision areas.

CHAPTER 3 - STRATEGIC AND STRUCTURAL PERSPECTIVE OF INTER-ORGANISATION RELATIONSHIPS

SUMMARY

There is no one body of literature or subject area that deals with strategic and structural aspects of inter-organisational relationships. Different subject literatures have contributed work in this area from different perspectives.

The strategic management literature has contributed, amongst other concepts, the work on value chains. Value chains link together value-added internal activities. Value systems link different organisations' value chains. The literature on value chains and value systems is reviewed; it is identified that strategic management of the value chain can provide competitive advantage.

Inter-organisation relationships evoke concepts and theories on the different types of relationships between the parties. This can be considered at the micro level (examined in the next chapter) or at the level of the market. This chapter considers the level of the market. A spectrum of different types of relationships from the hierarchical form of vertical integration through to arms length trading are examined; these different types of relationships give rise to different market structures.

Trends in the incidence of different relationship types are observed. It appears that co-operative types of relationship are increasing in popularity and vertical integration is declining. This implies that supply chain management will involve managing across organisation boundaries where the players are not connected by equity but by agreements.

The nature of the structure of interconnected networks of organisations is examined, drawing from the channel management literature, manufacturing strategy and the more recently formed network literature. It is identified that network structures are becoming leaner. The benefits of focused tiering of networks, particularly supply networks, are identified. The implications of position in the network are discussed.

It is concluded that much of the recent research has concerned types of relationships such as comakership. There is little evidence of research in less formalised types of longer term trading relationships to provide a comparison.

It is also concluded that position in the supply chain appears to be a significant factor in strategic behaviour.

INTRODUCTION

The objective of this chapter is to review work in relevant literatures to draw out an understanding of strategic and structural aspects of inter-organisation relationships.

It was identified in the previous chapter that manufacturing strategists, notably Hayes & Wheelwright (1984) had identified the significance of the concept of value added and the value added chain. The source of this concept appears to be in the strategic management literature which will be discussed in this chapter.

The discussion in the previous chapter identified that manufacturing strategists (for example Hayes & Wheelwright 1984 and Hill 1989) had highlighted the significance of ownership of the chain or, if not an equity relationship, the type of relationship between parties in the chain. Much of the work in this area has been contributed by the area of industrial economics, though business strategists and information systems strategists have also made notable contributions. This chapter will identify the different types of relationship, consider trends in their incidence and also highlight factors which may cause certain types of relationship to be adopted.

It was observed in the previous chapter that recent manufacturing strategy works (notably Womack et al 1990

and Slack 1991) had identified the strategic importance to operations of studying networks. This perspective is relatively new to operations management. Much of the work to date on networks has been generated by the industrial marketing, purchasing and business strategy literatures. This work will be reviewed here, identifying key aspects of networks that may impact on supply chain management.

Firstly the work on the value chain will be considered.

THE VALUE CHAIN / VALUE SYSTEM

Strategic Management authors, notably Porter (1980, 1985, 1987), also Johnston & Lawrence (1988) and Kogut (1985), have identified the strategic significance of managing the chain of value added for products and services.

Porter (1980) described the value system as the sum of the value chains of suppliers, manufacturers, distributors and end customers. In **"Competitive Advantage"** (1985) he represented the value system as shown below in figure 3.1.

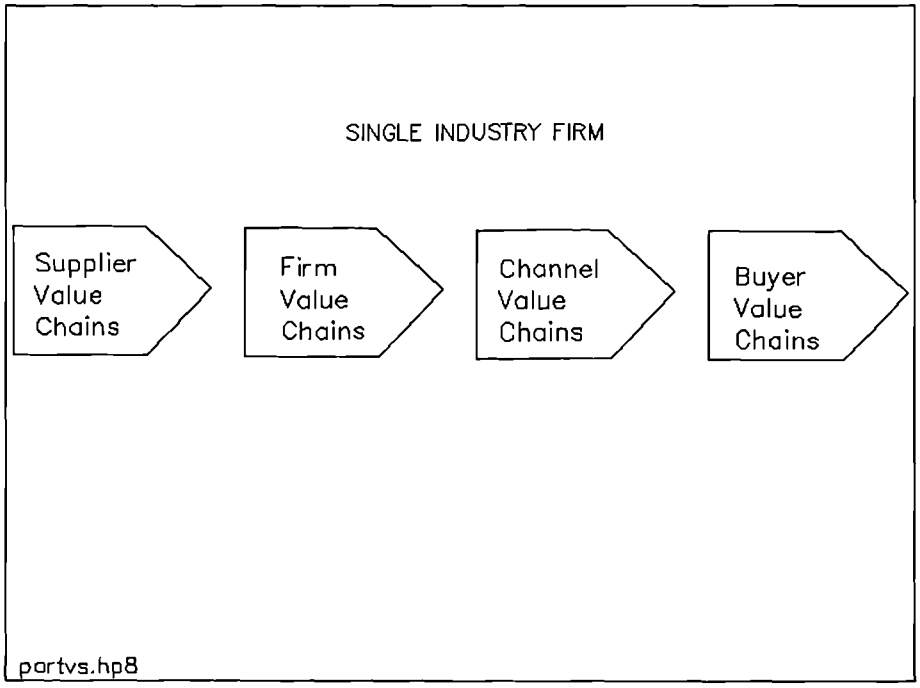

Figure 3.1: **The value system** Source: Porter (1985)

Inside one link of the value system is the **value chain.** Porter divided the activities in the value chain into **"primary activities"** and **"support activities"** as shown below in figure 3.2.

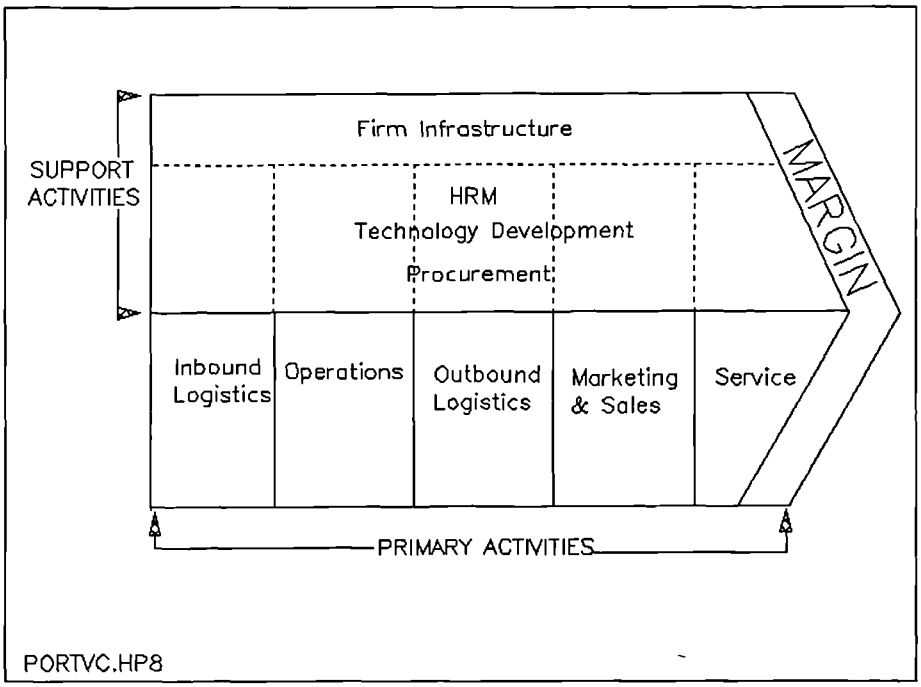

Figure 3.2: **The value chain** Source: Porter (1985)

In the value chain, value activities are related by linkages i.e. relationships between the way any one value activity is performed and the cost or performance of another.

Porter identified that it is often possible to benefit the firm and its suppliers by:

- influencing the configuration of suppliers' value chains to jointly optimise performance

- improving co-ordination between a firm and its suppliers' value chains or its channel value chains to lower cost or enhance differentiation

This highlighted the potential advantage of managing beyond the company boundary to improve output performance or to improve cost management.

In discussing the value chain, Kogut (1985) identified that different organisations in the same market own different amounts and different parts of their value chain. They choose how much of the chain to own and which particular links they should have control over. Kogut proposed that this choice should be directed by the competitive advantage to be gained by investing in a particular link. This competitive advantage should be judged in terms of the resulting impact on product attributes desired by consumers.

In addition to discussing competitive advantage to be gained through managing the value-added chain, Kogut also discussed **comparative advantage.** This is advantage gained through planned location of the links of a supply chain internationally. As different countries and cultures offer different benefits, they may suit different firms' strategies to a varying extent.

Other authors who have since used the term of value chain include, for example, Johnston and Lawrence (1988) who stated:

> **"The term value added chain comes from the field of micro-economics, where it is used to describe the various steps a good or service goes through from raw material to final consumption".**

They described a **"Value-Adding Partnership"** as:

> **"a set of independent companies that work closely together to manage the flow of goods and services along the entire value-added chain".**

and as an:

> **"organisational form much like the putting-out system of the early industrial revolution whereby manufacturing was done in cottages and coordinated by a merchant manufacturer who supplied the raw materials and sold the final product".**

Therefore a Value Added Partnership is a collaboration rather than an adversarial relationship or direct control through ownership i.e. an intermediate type of

relationship. This highlights the strong connection in the literature with the industrial economics and market organisation work that considers alternative organisational forms. It is evident that as well as contributing the concept of a chain of activities, the value chain authors also discuss the nature of the relationships in the chain. These warrant consideration in more detail; different types of relationships will therefore be considered in the next section.

TYPES OF RELATIONSHIPS

The type of relationship that used to be most commonly discussed in the strategic management and industrial organisation literature is vertical integration.

Historically the Western, particularly US, approach to gaining control of the supply chain was vertical integration through acquisition or merger (see for example Bain 1968, Clark 1961, Bucklin 1966, Harrigan 1983 and 1985 and Jacquemin 1987). Henry Ford had a sheep farm that grew wool for car seat covers; General Motors made car paint; newspaper magnates owned forests and paper mills; tyre manufacturers owned rubber plantations (Thackray 1986).

Significant attention has been paid in the literature to vertical integration. However it has been identified by many authors that management of the supply chain can be achieved types of relationship other than vertical

integration. The next section describes the range of types of relationship recognised in the literature.

The Relationship Spectrum

Discussion of alternative forms of organisation to vertical integration or market can be traced back as far as Marshal (1923). Since then various authors have identified different intermediate types of relationships in markets, notably Williamson (1975, 1985, 1986), Richardson (1972) and Blois (1972).

Coase (1937), in a ground breaking paper, considered the internal and external workings of a firm, highlighting that a firm can source supplies and services either internally from itself or externally from other firms. Williamson (1975) credits the start of this relationship work to Coase but has made the most significant contribution to the area in his development of Coase's original work.

Williamson categorised different forms of market organisation on a scale ranging from market (no interdependence) through **"relational exchanges"** (some interdependence) to hierarchy (ownership). Williamson was not the first to identify this spectrum of market organisation types; economists such as Richardson (1972) and Blois (1972) had identified the continuum of relationship types before him. However, Williamson's

classification and theories appear to be the most widely recognised.

There is a variety of terms in the literature for the intermediate form that Williamson termed relational exchanges. Blois (1972) referred to the middle ground relationships as **"quasi-integration"**. He described exchanges in these relationships as **"informal integration"**. Williamson (1985) also termed intermediate forms as **"contracting"**, recognising that contracting may be continuous or periodic, thereby indicating that there are differences between various intermediate forms.

Whilst the terminology of these intermediate forms may differ, there appears to be some common agreement on the nature of the organisational forms that lie between vertical integration and spot transactions. A useful classification was provided by Child (1987) as shown below in figure 3.3.

ORGANISING MODE	CONTROL & CO-ORDINATION	COMMON EXAMPLES
Integrated hierarchy	direct authority relations	single product firm
semi-hierarchy	arms-length control & periodic review	multi-divisional firm; holding company
co-contracting	arms-length control but the organisation also mediates between co-contractors	mutual organisation joint ventures
co-ordinated contracting	use of agreed specifications & deadlines; long standing trust relations	contractors and sub-contractors
co-ordinated revenue links	formal financial agreements; monitoring of service standards with franchising	licensing, franchising
spot network	limited to the terms of the contract	market transacting between independent traders

child.hp8

Figure 3.3: Spectrum of relationship types Source Child (1987)

Having identified the range of types of relationships now evident in markets, the next section considers any evident trends in the type of relationships being adopted.

Trends in Type of Relationship

Vertical integration appears to be declining. Thackray (1986) reported on vertical disintegration in manufacturing industries including automotive, machine tools, video recorders, industrial robots, optics, consumer appliances and medical equipment manufacturing. Porter (1988) reported that over half of acquisitions in new industries and over 60% of acquisitions in entirely new fields were divested, showing a desire of companies to reverse prior vertical integration decisions.

Dore (1983) argued that stable trading relationships are a viable alternative to vertical integration, using examples in the Japanese textile industry to support this. Significant evidence has been put forward for the increased incidence of buy rather than make strategies being adopted (see, for example, Dirrheimer & Hubner 1983, Kumpe and Bolwijn 1988, Gadde and Hakansson 1990 and Child 1987). i.e. organisational forms which involve contracting out are increasing in popularity.

Porter (1985) concurred that partnerships, alliances or co-operative agreements are proliferating rapidly and are present in many industries and many countries.

Having identified that changes are occurring in the types of relationships present in supply chains, the next section considers variables which appear to influence the type of relationship formed.

Variables which may influence the relationship type

The influencing variables reported in the literature include:

- Process type (Christopher 1985, Williamson 1985, 1986, Curran & Stanworth, 1983). For example, continuous process operations such as petro-chemicals, aluminium, zinc and paper production are often vertically integrated.

- Position in industry life cycle (Stigler 1951, and Porter 1988). Growing and maturing firms are less likely to vertically integrate. (However, Harrigan's 1983 empirical work contradicted this)

- Level of Information Technology available (McFarlan & McKenney 1982, McFarlan 1984, Child 1987). Information technology co-ordination of non-owned relationships.

- Desire to focus on a manageable set of products may lead to disintegration (Skinner 1974, Hill & Duke-Woolley 1988 and Miles & Snow 1986)

- Risk of ownership (Abernathy 1978, Harrigan 1983, Miles & Snow 1986, Hayes & Abernathy 1980); organisations fear getting locked into specific technologies

- Desire to keep control of critical activities favours vertical integration (Kumpe & Bolwijn 1988, Harrigan 1983, Kogut 1985, Hill 1989 and Nishiguchi 1987)

- Complementarity benefits of matching assets in the value chain can lead to vertical

integration or disintegration (Teece 1986, Mowery 1988, Doz 1988)

- Economies of scale (Dean 1951)

- Requirement for improved quality; traditional adversarial relationships are not conducive to generating good quality. (Frazier et al 1988, Lascelles et al 1990)

- Globalisation; co-operative relations can arise from the desire to have an integrated world wide strategy (Porter 1985)

It can be concluded from literature on type of relationship that, whilst most attention has been paid to vertical integration, increasingly other intermediate, collaborative types of relationship are becoming popular. Some of the reasons for this include the level of information technology available, the desire to focus and also the risk of getting locked into technologies if vertical integration is used.

Therefore supply chains are likely to contain a range of types of relationship from vertical integration through to arms length trading. In addition to the type of relationship, it is also necessary to understand more about the numbers of different relationships that organisations have and how many relationships there are

in chains. Therefore, the next section examines the structure of chains and networks.

STRUCTURE OF CHAINS AND NETWORKS

Much of the work on the structure of chains is evident in the channel management literature.

Channel Management

Lambert (1978) defined a channel of distribution as:

> **"the collection of organisation units, either internal or external to the manufacturer, which performs the functions involved in product marketing"**

Stock and Lambert (1987) described how goods must be physically transported between the place they are produced and the place they are consumed. If direct contact is made between every supplier and every customer, a large number of contacts occur, as shown below in figure 3.4.

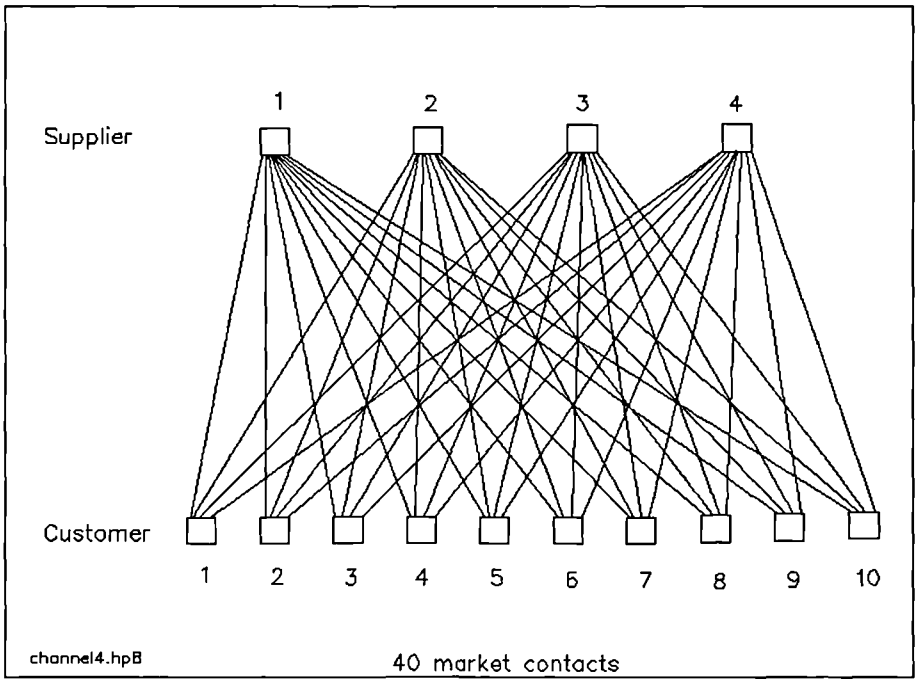

Figure 3.4: Direct selling to customers

Selling through an intermediary can reduce the number of contact points made in the market and also improve service to the customer as they deal with one point of contact, as shown below in figure 3.5.

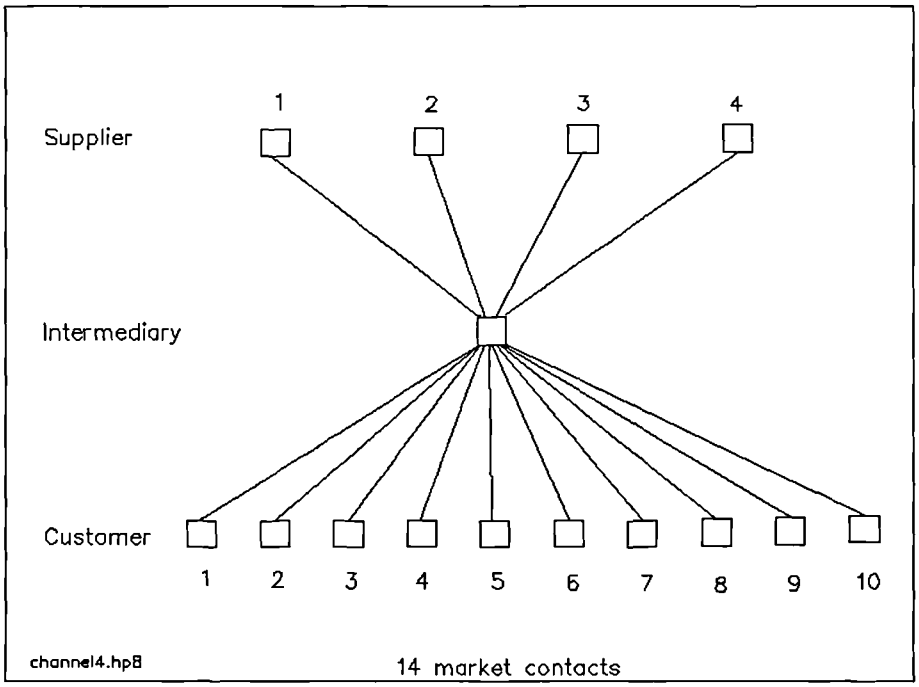

Figure 3.5: Selling via an intermediary

Channels have therefore evolved to fulfil this intermediate role between manufacturer and consumer.

Not all channels have evolved in the same way. Different channel structures are apparent in different markets and for different products. Stock and Lambert's (1987) figure of alternative structures of channels of distribution of industrial goods is shown below in figure 3.6.

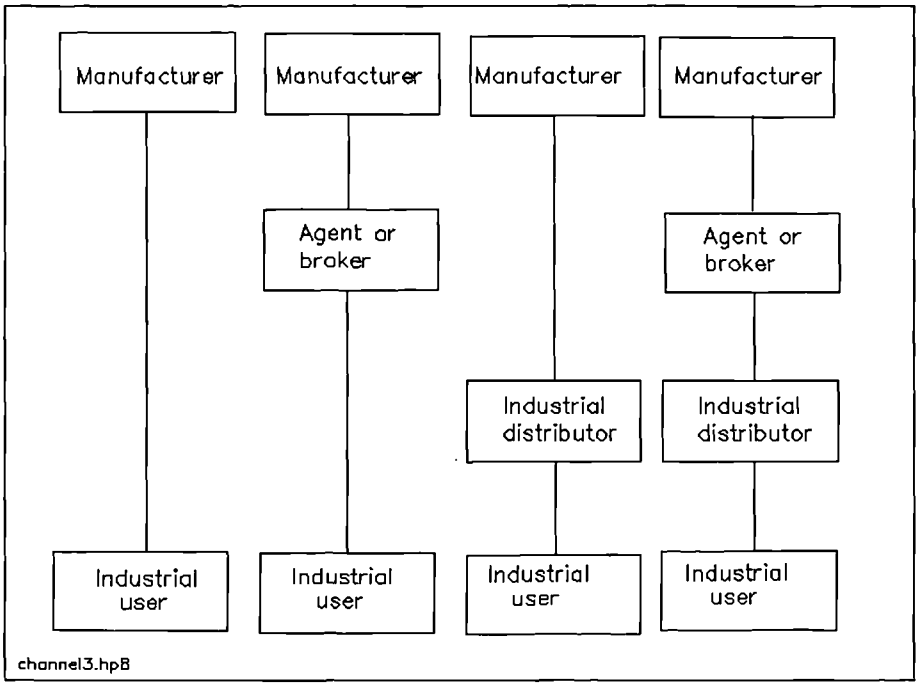

Figure 3.6: Alternative Channels of Distribution for Industrial Goods. Source: Stock and Lambert 1987

These variations of structure show differences in the existence, ownership and role of intermediaries. From this figure two observations can be made.

(i) The channel here starts at the manufacturer and flows downstream to the consumer; there is no

consideration of structure upstream of the manufacturer.

(ii) The channel is represented as a simplistic linear structure. There is no consideration of the number of separate relationships present at any one level or echelon in the channel.

Whilst the first point appears to hold true for most of the channel literature, the second point is purely one of simplification, rather than a conceptual issue. Indeed Stock and Lambert (1987) recognise channels as being:

"loosely structured networks of vertically aligned firms"

This is evident in further examples of channels they provide, two of which are presented below in figures 3.7 and 3.8.

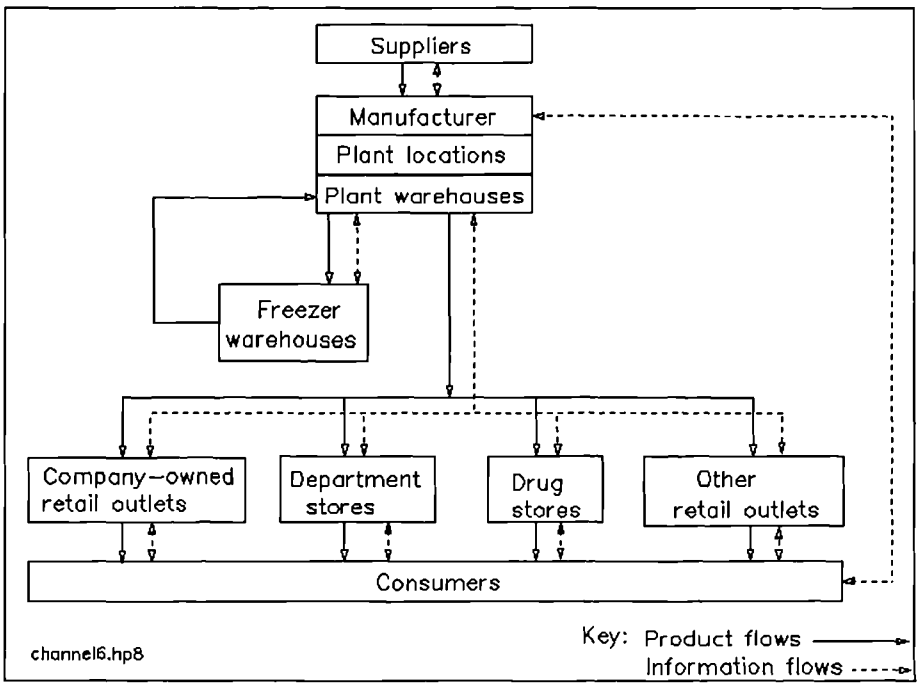

Figure 3.7: **Example of Distribution Channel for Chocolates.** Source: Stock & Lambert (1987)

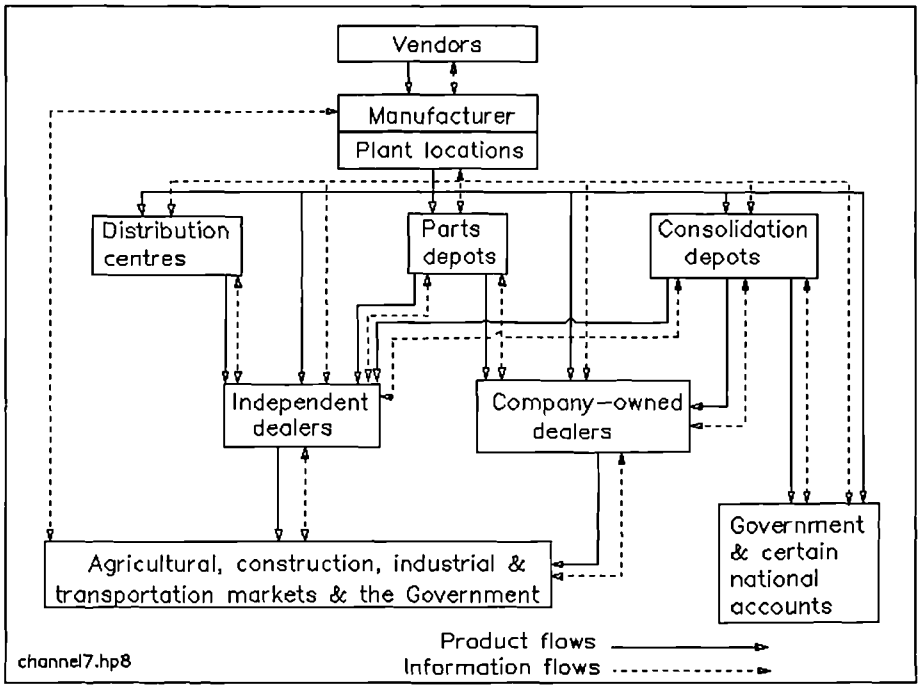

Figure 3.8: **Example of Distribution Channel for Industrial Goods.** Source: Stock & Lambert (1987)

Achrol et al (1983) identified that a focal firm in a channel deals with its own immediate suppliers and its own immediate customers. The firm is also immediately affected by competition and any regulatory bodies. These relationships they termed the **"primary task environment"**. The **"secondary task environment"** included suppliers' suppliers and customers' customers as well as potential competition and interest aggregators (part of the regulatory environment). Their model of the channel in its environment is shown below in figure 3.9.

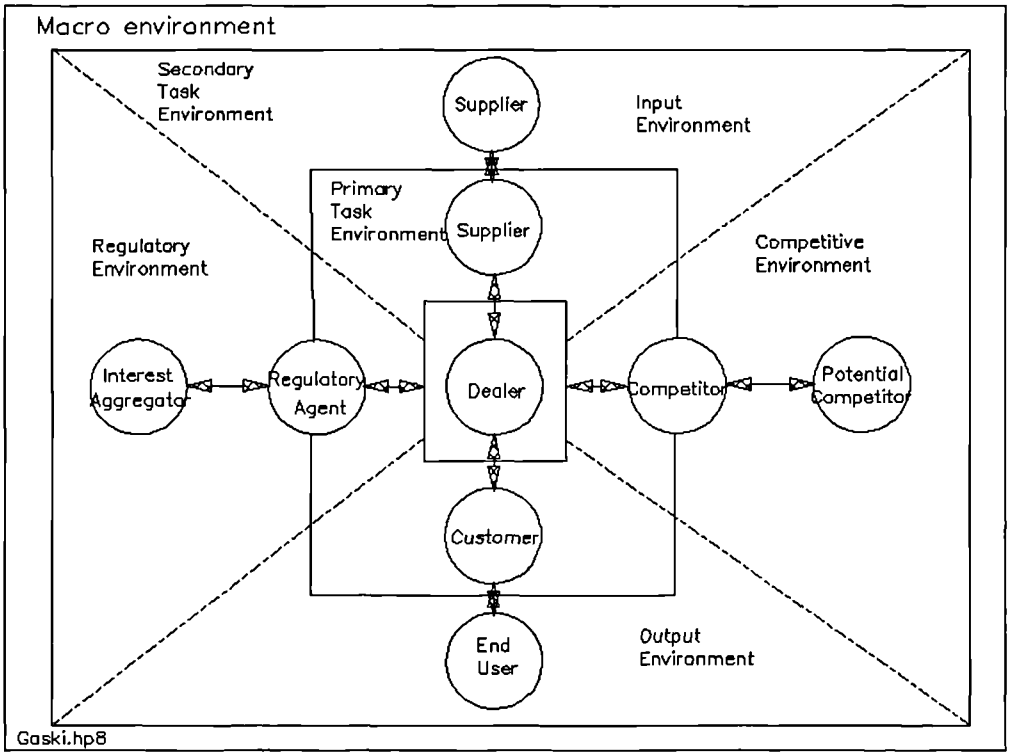

Figure 3.9: **The Channel Environment.** Original Source: Achrol et al (1983)

Their model did include consideration of the upstream supply market, but their research focused attention on a dealer and the distribution system downstream of the

dealer. The dealer was asked questions about its suppliers but it does not appear that the researcher investigated the upstream companies.

Therefore it can be seen that the channel management literature has focused on the links in the supply chain downstream of the manufacturer. Kotler (1984) highlighted that too little marketing attention has been paid to exchange relationships for components and materials that go to make the finished product. Most attention in the marketing area has focused on finished goods only and, in particular, on consumer marketing.

Whilst the channel management has not considered supply chains upstream of the manufacturer, authors from the industrial marketing, purchasing and strategic management literatures have evolved concepts to consider the entire network.

Networks

Depending on its position in the network, a focal firm has its own unique pattern of upstream and downstream relationships. This is demonstrated below in figure 3.10.

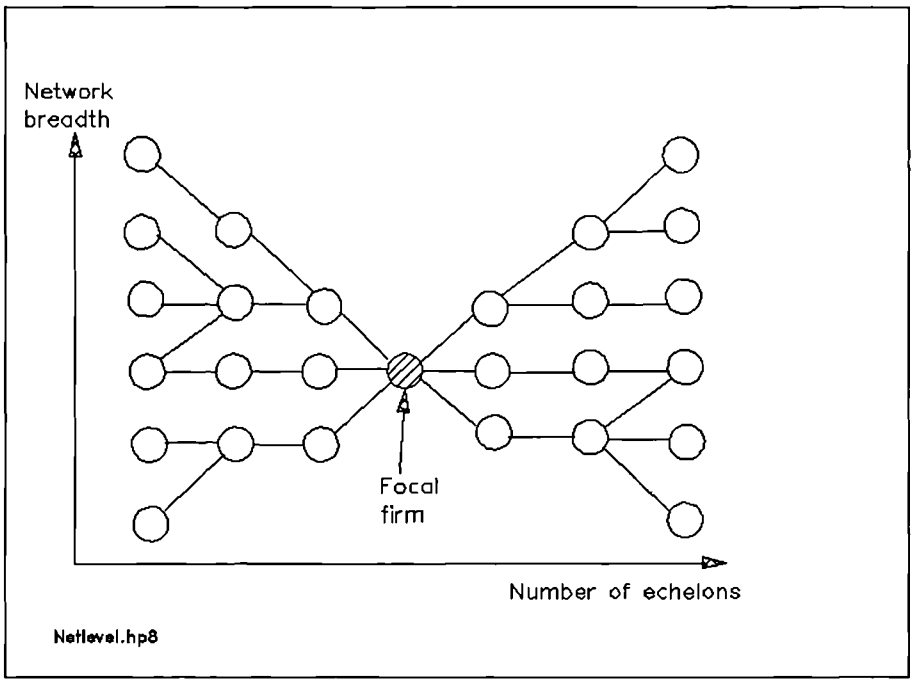

Figure 3.10: Example network

As can be seen in the above figure, networks can differ according to the aspects of the shape; notably:

(i) The breadth of the network (relating to the number of suppliers and customers the focal firm and its subsequent connections deal with)

(ii) The number of echelons or levels in the network (i.e. the intermediate stages in the network between original source and ultimate consumer)

(iii) A firm can be in different positions within the network i.e. further upstream or further downstream than other players

A collection of studies originating at the University of Uppsala in the mid 1970s lead to the formation of the IMP - Industrial Marketing and Purchasing group - who have generated a body of work that can be referred to as the network literature (see Ford et al 1986, Mattsson 1985, and Turnbull & Valla 1986, as examples)[1].

The significance of breadth, number of echelons and position in the network will now be considered.

(i) The breadth of the network

During the 60s and 70s many Western countries, notably the US and the UK, used multi-sourcing to encourage price competition between suppliers. This trend has been turned round in the 80s and 90s with companies reducing their supplier bases significantly (see, for example, Farmer and Ploos van Amstel 1991, and Newman 1988). Morgan (1987) commented on what was termed the "purchasing revolution" observing that the use of single sourcing was increasing. Turnbull & Valla (1986) and Hakansson (1989) suggested that most networks now are concentrated and structured.

Nissan and Rank Xerox provide two examples of significant reduction in supplier bases undertaken by manufacturers. Nissan Manufacturing UK limited its supply base to 170 suppliers, with all commodities being single sourced

1 The IMP contribution to understanding the patterns of day to day connections in networks will be considered in chapter 4

(Griffiths 1992). Rank Xerox had almost 5000 suppliers in 1981 but had reduced this to little more than 300 by 1987 (Morgan 1987). Lamming (1989) reported that Japanese lean producers involve fewer than 300 suppliers in new product development projects compared to typical Western equivalent manufacturers who may deal with 1000 to 2500.

In the service sector, Barnes (1987) talked about **"reshaping the supply chain"** in health care delivery systems and how materials managers :

> **"could reduce the number of distributors dealt with by identifying the ones who can best work with him or her in fulfilling program objectives".**

This highlights that concentration in the network is not only a phenomenon of manufacturing oriented chains but is also evident in service sectors.

Concentrating sourcing on a smaller number of suppliers can increase risk. As a hedge against this risk Sabel et al (1987) report that Robert Bosch Gmbh, the German automotive components manufacturer and distributor, require that sub-contractors do no more than 20% of their business with them so they do not become too reliant on them. In addition, Bosch gain benefits from the fact that all their suppliers have to deal with their competitors as well, giving them the opportunity to learn about them via the suppliers.

Therefore there is agreement in the literature that supplier bases are being reduced; this impacts on the breadth of the network.

A similar trend is reported in the downstream side of the network. Womack et al (1990) reported that distribution networks were becoming leaner in the automotive industry in the Japanese lean producers such as Toyota and in Europe notably in Volvo.

Lamming (1989) identified several factors that have lead to a reduction in the number of suppliers dealt with in the automotive industry, for example:

- the need to enable JIT supply
- the need for stringent quality assurance compliance
- removal of dual sourcing policy
- modular design of vehicles enabling VMs to buy modules
- the need to reduce overhead costs by reducing the number of communications necessary

Therefore, the literature paints a picture of narrower networks in the 1980s and 1990s. The next section examines the connection between network breadth and performance.

Network breadth and performance

Easton & Quayle (1990) investigated the differences between single sourcing networks and multiple sourcing networks. They proposed that single sourcing networks would be more rigid and stronger in that there would be dense flows of exchanges between them.

However, they identified advantages of multi-source or broad networks claiming that they would be better placed to adapt to changes in the environment. The presence of more routes in the network to switch to would increase the likelihood of being able to select a route that matched a new environment.

Easton & Quayle also highlighted benefits in multi-source networks of greater knowledge sharing through more contacts. Single source networks contain a more limited contact set from which knowledge can be gained. However, a knowledge benefit of single source networks (significant to their particular studies in the defence industry) is the ability to keep secrets.

Puto et al (1985) advocated multiple sourcing as an important strategy for firms who needed to reduce uncertainty in purchasing.

Therefore, it can be seen that, whilst there is general agreement on the reduction of multi-sourcing in networks, there is a range of views on the relative merits of

single and multi-sourcing. Some of these views of the relative merits are summarised in the table below.

Advantages of Broad Networks	Advantages of Lean Networks
Adaptable to change	Rigid and strong
More switching opportunities	Dense flows of information
Wider access to knowledge	Higher confidentiality
Hedge against uncertainty	

Table 3.1: Relative Merits of Broad vs Lean networks

Having considered the breadth of the network, another dimension of network shape is the number of echelons or levels.

(ii) The number of echelons or levels in the network

Nishiguchi (1987) reported how Toyota and other Japanese companies had organised their suppliers into hierarchies; first tier or primary suppliers provided systems rather than components. This had the effect of significantly reducing the number of suppliers dealt with on a direct supply basis, though not necessarily reducing the number of supply sources in the network in total. It did impose more levels in the network. It also made the buying company more dependent on each supplier, whereas the traditional broader network attempted to reduce dependency to suppress prices and maintain competition.

Nishiguchi (1987) discussed three models for supply systems in the automotive industry, being:

- vertical integration
- strategic dualism
- clustered control

Vertical integration has already been discussed earlier.

Nishiguchi describes strategic dualism as being where the final assembler tries to outsource component manufacture as much as possible while retaining manufacture of key components.

Nishiguchi's model of clustered control is one of a tiered structure where the assembler deals with a small number of primary suppliers who each deal with a small number of secondary suppliers and so on. The clusters under one assembler intricately overlap with those under other assemblers, as shown below in figure 3.11 which Nishiguchi refers to as an Alps structure.

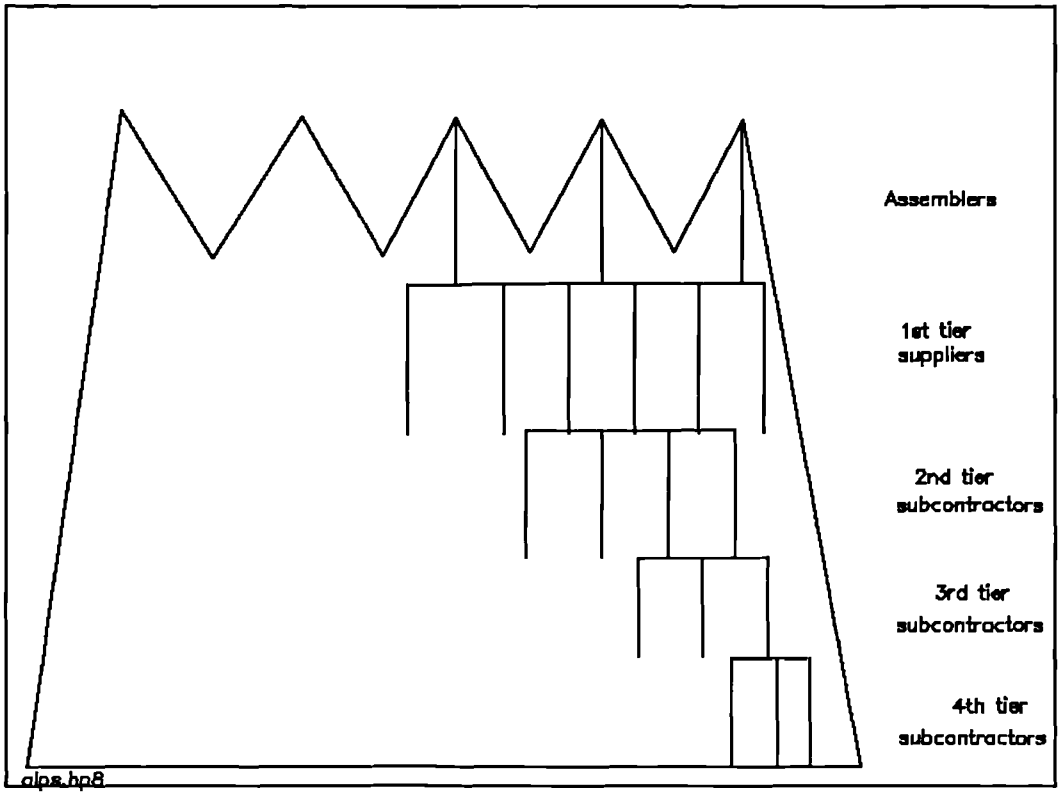

Figure 3.11: Alps supply system Source Nishiguchi (1987)

In clustered control, Nishiguchi identified that the close collaboration between the assembler and its suppliers owes much to the strategically created **"keiretsu"**. These are complex relationships between companies involving equity ownership and interlocking directorships.

Therefore it can be concluded from the literature that in some networks a strategic approach has been taken to determining appropriate collaborative structures for the network which involve tiers of interconnected, focused levels.

Having discussed structural issues relating to the total network, structure also implies that each network player has a position in that structure. Possible implications of position in the network will now be considered.

(iii) Position in the network

Hayes and Wheelwright (1984) in their discussion of vertical integration and sourcing identified implications of position in the chain, providing a generalised view of differences between upstream links and downstream manufacturing links. They identified the implications of a manufacturer's position in the supply chain relating to (i) demand volatility, (ii) asset intensity, (iii) profitability, (iv) technological change and (v) scale and balance.

Each of these will be discussed here.

- Position in chain and demand volatility

  Here they refer to the **"the accelerator effect"** caused by **"amplifications and delays that are built into the typical supplier-customer pipeline".** This involves progressive distortion of demand swings the further upstream.

- Position in chain and asset intensity

Hayes & Wheelwright proposed that an upstream manufacturer is likely to provide more standardised products and narrow product lines using more automated, connected machinery than downstream manufacturers. This is because of scale economies. Therefore, there is greater asset intensity upstream rather than downstream when comparing manufacturing operations in a chain.

- Position in chain and profitability

Following from the previous point that upstream manufacturers gain economies of scale, they describe how the accelerator effect can damage profits in upstream businesses. As minimum volumes are required to cover fixed costs in large scale businesses, the response to a downfall in demand is not likely to be a volume reduction, but more likely to be a price reduction. This is in contrast to manufacturers further downstream who are more able to reduce volumes of output as demand swings.

They conclude that a manufacturer who decides to vertically integrate upstream in the supply chain must accept **"higher fixed costs and higher asset intensity in order to achieve lower variable costs and control over its operation".**

- Position in chain and technological change

  Hayes & Wheelwright claim that companies may justify backwards integration in the chain **"to develop competence in the technology of a critical component, to develop proprietary products, or to stay abreast of technological change".**

- Position in chain and scale and balance

  Choices have to be made about which customers or suppliers to vertically integrate into the business. There is then the issue of whether the capacity of all the units should be in balance or whether trading should occur with businesses **"outside"** the vertically integrated firm to dispose of additional output or draw in additional inputs.

Therefore, it has been identified that the shape of the network, in terms of its breadth and the number of echelons in it, will impact on the players in the network. Also, the relative position of any player in the network will have implications.

In addition to passively observing features of networks, some literature has identified strategic approaches to be taken in networks.

Cunningham (1990) suggested that competitive advantage can be gained by creating and harnessing the resource potential of the network in a more effective manner than competing firms. In surveying the work of Scandinavians such as Hakansson and Johanson, Cunningham (1990) identified that the network perspective can influence competitive behaviour and makes the following issues important:-

- selection of collaborative partners in the network
- establishing a competitive position in the network
- monitoring yours and competitors positions in the network (this refers to strategic position, not location as the term was used for earlier)
- how the network relationships are handled

However, most of the IMP Group's work has focussed on one set of exchange relationships i.e. at one dyad; see for example Gadde and Matteson (1987) who focus on what they term *"the intermediary network"* between one set of producers and a set of customers.

Therefore, it can be concluded that little research has been performed to date in large parts of networks.

CONCLUSIONS

To summarise the focus of interest of different groups, the two dimensional framework provided earlier is used

here to locate the main groups of strategic and structural work on inter-organisation relationships.

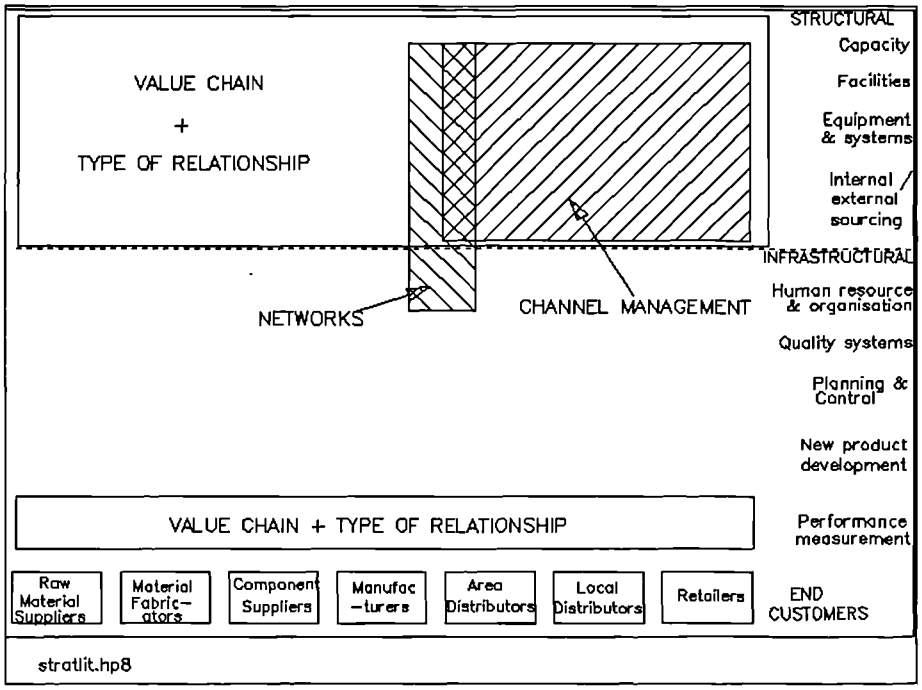

Figure 3.12: Coverage of main bodies of strategic / structural literature on inter-organisational relationships

The following conclusions can be drawn:

- Much of the work in this area has been contributed by industrial economists

- Different terms have been used for the same market organisational forms

- There appears to be some acceptance of the existence of a spectrum of organisational forms ranging from hierarchy at one end to market at the other.

- There is less clarity regarding the organisational forms between market and hierarchy within this spectrum.

- Little attention has been paid to the different trading relationships recognised in the purchasing literature, in particular the long and medium term trading relationships

- It appears that little has been questioned when defining organisation types about what is being transferred or the length of timescale of the commitment.

- Networks are becoming leaner and more manageable

- Channel literature has tended to focus on environment and structure

- Most work is evident in original equipment automotive and electronics chains i.e. medium to high volume, low variety

- Position in the network appears to be a significant factor, though there is little evidence of empirical research at a strategic level (note that position in the network will be considered from an infrastructural perspective in the following chapter)

Having discussed strategy and structure of chains and networks in this chapter, the next chapter considers the nature of exchange within an existing structure.

CHAPTER 4 - INFRASTRUCTURAL PERSPECTIVE OF INTER-ORGANISATION RELATIONSHIPS

SUMMARY

The previous chapter examined strategic and structural aspects of relationships across organisation boundaries; this chapter considers the infrastructural aspects of these relationships i.e. the nature of the inter-organisation connections within the structure on a day to day basis.

This chapter is divided into consideration of short term exchange and longer term relationships.

The examination of short term exchange episodes draws on the operations planning and control, industrial dynamics and logistics literatures. These literatures have taken a hard, materials management perspective. Operations planning and control and logistics have focussed on processes and systems to improve efficiency of material flow through chains; these include MRP / DRP and JIT. Industrial dynamics have provided an effect - **the Forrester effect** - to explain the effects of dynamic volatility of information in supply chains.

Longer term relationships are categorised to differentiate between different types of exchange. It is identified that in some relationships only goods and services are exchanged but in others resources such as people, technology and systems may be shared.

It was concluded in the previous chapter that co-operative relationships are increasing in popularity. However, it is concluded in this chapter that relatively little work has been performed to examine what is exchanged in longer term relationships, other than comakership and partnerships. There is little evidence of work that examines the nature of exchange in longer term, less formal relationships.

INTRODUCTION

This chapter considers the nature of the connections between parties in networks on a day to day basis. These connections may be the transactional exchange of goods and services for payment, or longer term connections between the parties such as sharing of technology, people, systems and knowledge.

The literature associated with these connections is to be found in different academic subjects areas. Exchange is examined in the traditional Marketing and Purchasing literatures. Work examining the physical volume and timing issues of material flow in networks comes mainly from the operations management, industrial dynamics and logistics groups. Work that considers the co-operative nature of the relationships is to be found in the more recent purchasing / partnership literature.

Work that considers payment flows in networks is to be found in the accounting and finance literature by consideration of transfer pricing, and in the purchasing and marketing literature which considers reciprocal trade. As payment flows are not central to this research, they are not considered in any detail here.

Also, it is recognised that the marketing literature has paid significant attention to the issues of power and dependency between organisations, though this is not researched here.

Firstly the nature of exchange is considered.

EXCHANGES / RELATIONSHIPS

The core concepts of marketing (Kotler, 1991) relate to understanding of:

- Needs, wants and demands
- Products and services
- Utility, value and satisfaction
- Exchange, transactions and relationships
- Markets
- Marketing and marketers

The exchange relationship is the core phenomenon for study in marketing (see, for example, Alderson 1965, Bagozzi 1975 and Dwyer et al 1987). For exchange to take place, 5 conditions must be satisfied (Kotler, 1991)

1) There are at least 2 parties
2) Each party has something that might be of value to the other party
3) Each party is capable of communication and delivery
4) Each party is free to accept or reject the offer
5) Each party believes it is appropriate or desirable to deal with the other party

A **transaction** takes place if agreement is reached between the parties; transactions are the basic unit of exchange.

A transaction is a one-off event which, once completed, could end the exchange process. However, continued transactions can lead to the building of a **relationship** between the parties which ties the parties together economically, technically and socially.

Because of the set-up costs of successfully completing a transaction, including finding out about the other party, negotiation and formation of the agreement, it is economic to repeat transactions, enabling them to be more routinised (Ford, 1978). In addition to routinisation, there is greater opportunity for the parties to adapt to each other when transactions are repeated; Ford (1980) observed that these adaptations become institutionalised and can be cost beneficial to both parties. Therefore the literature indicates some performance benefits of relationships over transactional exchange in terms of cost performance.

Marketing concepts relating to exchange were historically focused on consumer marketing, despite the fact that the value of inter-firm transactions is significantly greater than transactions involving the consumer; Rowe & Alexander (1968) estimated that non-consumer sales valued 3.5 times sales to consumers.

Differences between industrial buying and buying consumer goods have been identified by Hakansson and Wootz (1979) as including:

- Industrial sellers' ten largest customers may account for most of their sales. In consumer markets individual consumers usually account for a very small part of the supplying company's sales.

- Industrial buyers have greater resources available to them than do consumers. They are therefore able to use these resources to make more informed decisions.

- There is more interaction between buyer and seller in industrial purchase situations.

This last point in particular lead them to conclude that the industrial buyer-seller relationship is more symmetrical than its consumer equivalent and involves each party reacting to the others actions and adapting to the other party. This can result in very close and lasting relationships (see Wind 1970 and Luffman 1974), the type of which are not usually apparent in consumer markets, except in special cases.

The traditional Purchasing literature took a rational, negotiated approach to purchasing from suppliers, optimising the best combination of the "Five Rights" i.e.

"To purchase the right quality of material, at the right time, in the right quantity from the right source, at the right price" (Baily and Farmer 1985)

However, there are severe doubts about the validity of traditional assumptions about the "rational" industrial buyer. The buyer was encouraged to take an adversarial position to its suppliers using a variety of negotiation techniques to gain control over sales representatives (see for example England 1967, Westing, Fine & Zenz 1976 and Lee & Dobler 1977) to negotiate the "best deal" in terms of the five rights, though the rationality of this process is questioned.

The focus of traditional purchasing texts was on short term transactions. It is only relatively recently that purchasing texts have acknowledged trading of a longer term nature with suppliers in the form of relationships; (see, for example, Farmer and Ploos von Amstel 1991).

Conceptualisation of these different types of short and long term interaction can be found in the Industrial Marketing and Purchasing (IMP) development of the **interaction approach.** The interaction approach is based on continuous exchange relationships occurring between a limited number of identifiable actors (Hakansson and Snehota 1989); it incorporates aspects of inter-organisational theory (Van de Ven et al 1975) and the

"new institutionalists" from industrial economics (Williamson 1975).

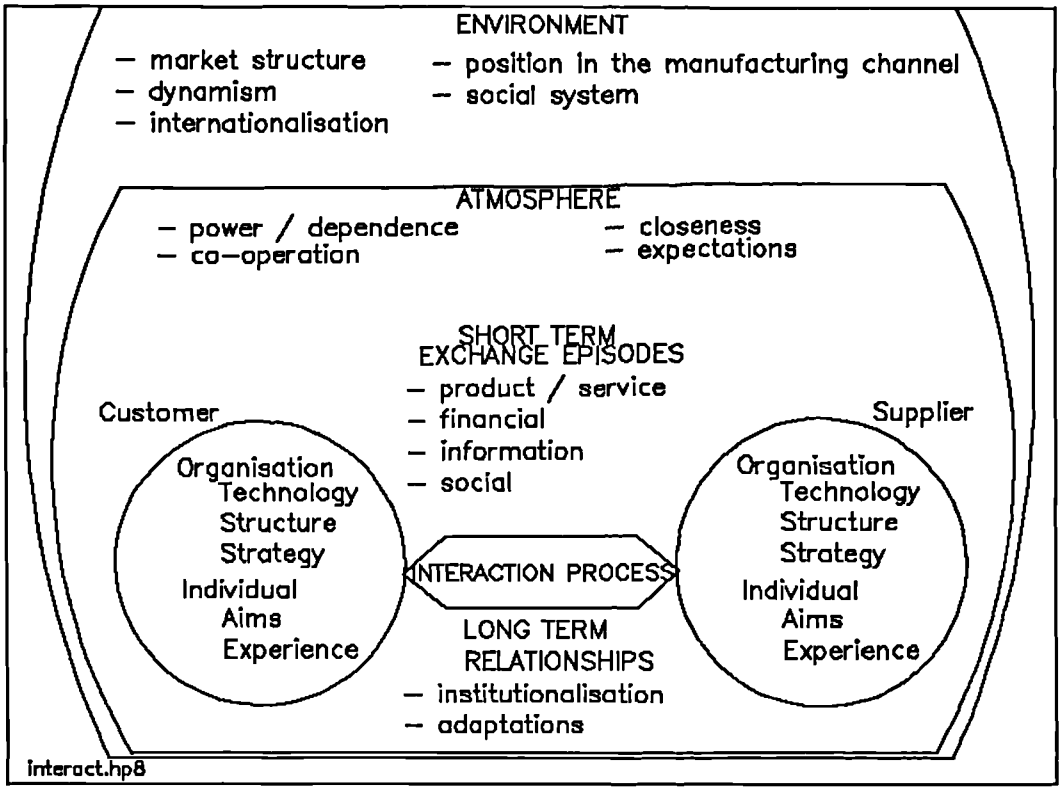

Figure 4.1: **The Interaction Model.** Source: Hakansson (1982)

This chapter examines short term exchange episodes, and long term relationships, identifying in particular literature dealing with exchange over a string of dyads, or a chain.

SHORT TERM EXCHANGE EPISODES

In the short term, industrial organisations exchange various elements including the product or service, finance and social elements. The process of exchange usually begins with information exchange including specifications of the product or service, references of product / service approval from other companies, references of financial approval of the buying company and information about likely volume and timing requirements. This initial stage may involve passing of a large number of different pieces of information; Hakansson, Johanson and Wootz (1977) and Hakansson and Wootz (1979) identified that the higher the level of technology and / or the higher the value of the product / service being exchanged, the greater the potential risk and therefore the more information will be required prior to product / service exchange taking place.

Social exchange in short term episodic transactions helps to ensure smooth exchange and remove problems. In the longer term, the string of episodic social exchange can lead to trust and even friendship between the representatives of the customer and supplier. This is particularly important if the exchange is not formalised by a written contract (Macauley, 1963).

Operations planning and control has focussed on product and information exchange in short term episodes across company boundaries i.e. the information is mainly

logistical, relating to volume and timing. Marketing's contribution to short term episodic exchange of volume and timing aspects beyond the dyad is, what they term, logistics. Engineering study of the volume and timing aspects of episodic exchange in chains is contained in the field of Industrial Dynamics. Whilst a division of the literature in this area is not clean, three main bodies of work - planning and control, logistics and industrial dynamics - will now be considered.

The Operations Planning and Control Work

In Operations Management, most of the work in planning and control relates to processes internal to the organisation. However, since the mid 1980s there is evidence of work relating to planning at control between organisations. The newly developed concept of supply chain management will be considered in the next chapter. The planning and control work considered in this section includes brief examination of inventory management, Materials Requirements Planning (MRP I), Distribution Resources Planning and Just-In-Time.

Inventory Management

Prior to the widespread use of computers in inventory management from the 1960s onwards, inventory requirements were often calculated stochastically (see Leenders et al 1980, Buffa & Miller 1979, Hadley & Whitin 1963 and Peterson & Silver 1979)

The signal to replenish inventory was raised by periodic review of inventory levels or by the inventory level reaching a re-order point.

The volume to replenish inventory by was calculated as the amount required to top up to a predetermined level or as a fixed order quantity. When ordering from suppliers, this fixed order quantity could be determined using the Economic Order Quantity formula which traded off the cost of holding inventory against the cost of ordering.

However, stochastic based replenishment systems were **independent** of future demand; therefore as demand fluctuated away from historical patterns, shortages occurred (Orlicky 1975). This led to, amongst other outcomes, short term management of suppliers to solve crises.

During the 1960s planning and control systems became available to link replenishment with demand. Deterministic calculation of materials requirements across organisational boundaries is performed with suppliers through Materials Requirements Planning (MRP I) and with distributors using Distribution Resource Planning (DRP).

MRP/DRP

MRP is a computerised system that combines known orders and forecasts of future demand, then calculates volume

and timing requirements for materials. The calculation is performed by **exploding** higher level requirements through product structures (Bills of Materials) then netting off existing inventory. The demand for lower level materials is **dependent** on the higher level requirements (see Vollman et al 1989, Wight 1982 and Hall & Vollman 1978)

In addition to generating orders and schedules for production, MRP also produces orders and schedules for suppliers, and in that sense plans and controls across organisation boundaries.

DRP extends the principles of MRP down the supply chain through distribution. DRP authors such as Martin (1983), Ho (1993), Stenger & Cavinato (1979), Stanley (1991) and Bookbinder & Health (1988) implicitly refer to supply chains or parts of supply chains that are owned by the same company, referring to the part of the chain downstream of the manufacturer as **"the distribution function"** (Ho, 1993) or **"the distribution network"** (Stanley, 1991).Stanley's representation of an owned distribution network is typical of the DRP literature.

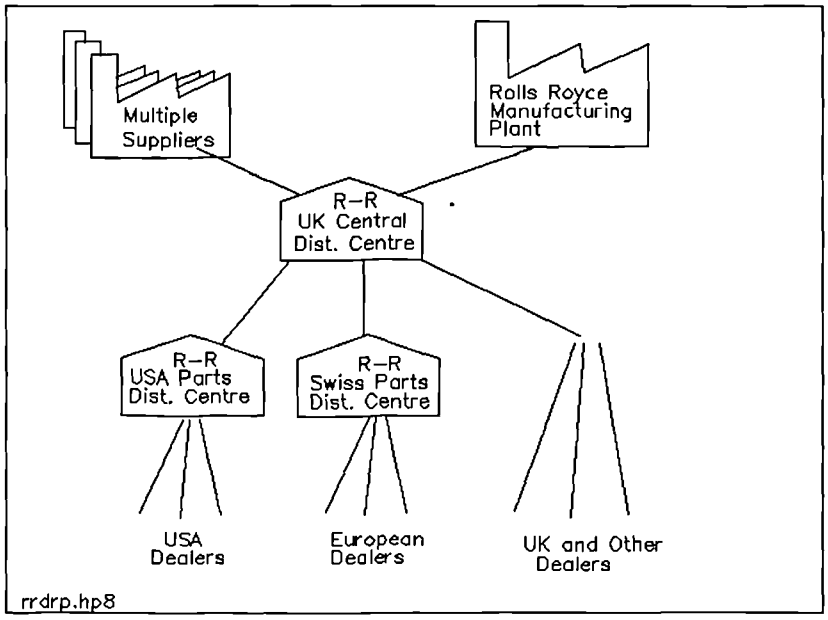

Figure 4.2: Typical DRP representation of a supply chain Source: Stanley (1991)

The DRP literature considers owned chains because DRP systems need to connect inventory files located at each link in the supply chain. They need to share common inventory item master file and transaction file data. This level of systems integration is most common in wholly owned distribution networks.

Critics of MRP/DRP implementations have identified that, whilst the deterministic logic is sound, **pushing** inventory along the chain leads to excessive inventory, system volatility and inability to respond to customer demand (see Hall 1983, Bicheno 1991 and Plenert & Best 1986).

A more recent response is to **pull** inventory through the chain. This is a concept behind Just-In-Time.

Just-In-Time

Most interest in JIT exchange has been evident in the operations management literature considering the component supply / manufacturer dyad (see for example Bartholomew 1984, Hall 1983 and Harrison 1992). Little attention has been paid to JIT exchange at this dyad by marketers whose attention has focussed on exchange of finished products to consumers Kotler (1984).

Hayes (1981) described JIT exchange as requiring the supplier to produce and deliver to the Original Equipment Manufacturer precisely the necessary parts in the exact quantities required at exactly the required time.

The principles of the materials management aspect of JIT were evident in the Toyota production system described by Taiichi Ohno (1978). One of the features of the Toyota production system was a new way to co-ordinate material flow into assembly called **kanban**. Kanban involved the tight control of supply to the next stage of production by authorisation of material release with a kanban (Japanese for card) or an empty container signalling the need to replenish. This became known as Just-In-Time in the West, though later the definition of JIT expanded beyond the kanban mechanism[1].

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1 The relational aspects of JIT are considered in the next section which considers what is exchanged on a day to basis in longer term relational exchanges

In a JIT operation there is no inventory slack to buffer against quality failure, late delivery or inaccurate volume delivery of incoming supplies; Shingo (1985) identified that, in its extreme form, JIT does not tolerate variances from plan. To achieve this exactness, JIT exchange requires integration of many sub-systems within the supplier and manufacturer including engineering, materials management, production and planning and control to promote the efficient flow of materials (Hahn, Pinto and Bragg 1983).

JIT therefore extends beyond management of inventory across organisation boundaries. The competitive advantage of this inventory efficiency in terms of improved flexibility and response lead time have been recognised (see, for example, Harrison 1993).

To summarise the operations planning and control literature contributions to inter-organisation exchange, most of the work appears to centre on improving inventory efficiency. This has been facilitated with the advent of computer systems to link demand to requirements planning.

To conclude where this work is positioned in the supply chain, it is evident that the DRP view focuses on the part of the chain downstream from the manufacturer and is generally based on owned chains. The inventory management aspects of planning and control have been considered in the upstream part of the supply chain.

The Logistics Work

Authors such as Bowersox (e.g. 1969, 1978, 1980, 1986, 1989, 1992), Christopher (e.g. 1969, 1971, 1979, 1985, 1989, 1992), La Londe (1989), Ellram (1989, 1990), Braithwaite (1992) and Sharman (1984) have examined different aspects of logistics. Central to the logistics literature are Christopher and Bowersox. La Londe and Ellram have considered the market organisation aspects of logistics; as they have contributed to the new concept of supply chain management, their work will be considered in the next chapter.

Bowersox et al (1992) defined logistics thus:

> **"The logistical process of a firm cuts across every internal organisational unit and reaches out to encompass customers and suppliers"**

In Bowersox et al's work in 1986, they considered a horseshoe information flow, distinguishing between the "Requirements Information Flow" from customers, through the organisation back to suppliers and the "the Value Added Material Flow" returning through the business, following the material path. Their model is shown below in figure 4.3.

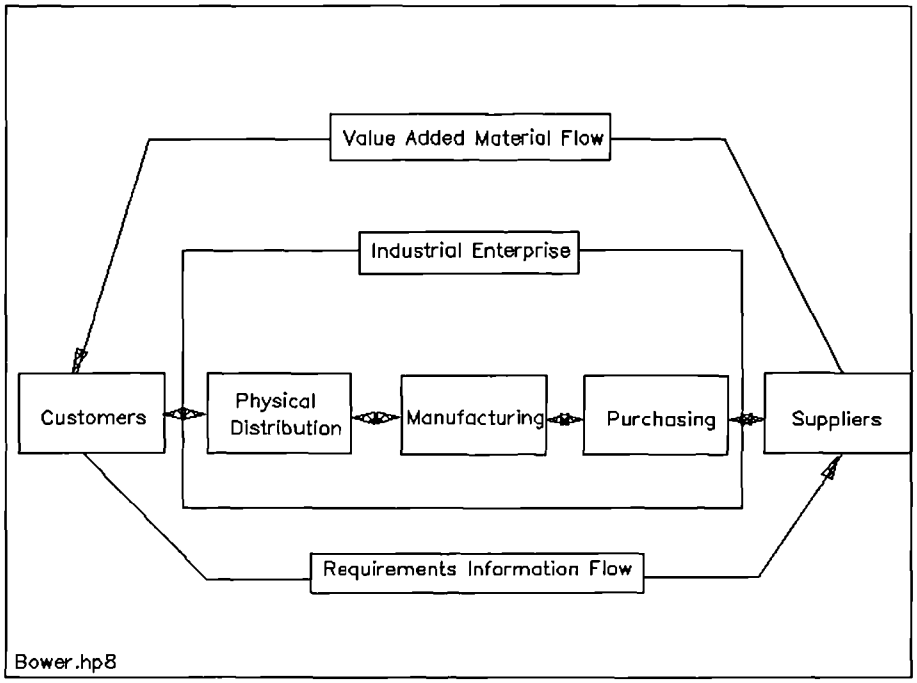


Figure 4.3: Flows in logistics. Source: Bowersox et al 1986

Braithwaite (1992) who based his ideas on Christopher, distinguished between the supply chain and the process chain as shown in the figure below.

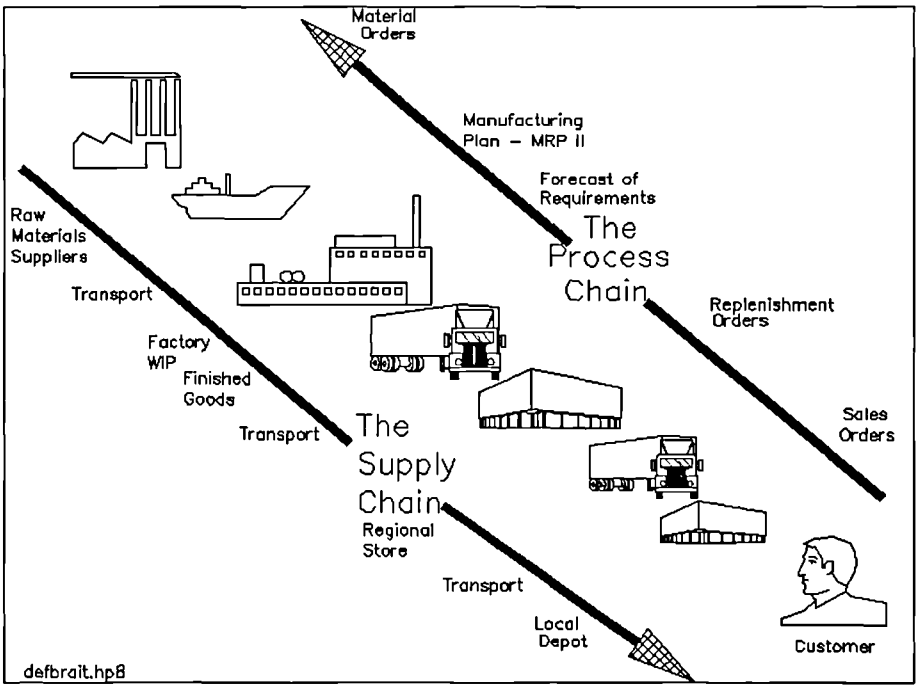


Figure 4.4: Process Chain and Supply Chain

Braithwaite described the supply chain as the physical flow of materials through physical facilities, using transport. He differentiated between this and the "process chain", defining the process chain as including:

- order management
- credit control
- replenishment / DRP
- forecasting and planning
- MRP / finite capacity scheduling

Essentially he describes a set of planning and control processes as the process chain but these are separate from the physical supply chain.

To conclude, logistics, like operations planning and control, is viewed as a process to manage materials flow in the supply chain. Most of the logistics work has focused on the supply chain internal to a business, interfacing with immediate customers. Notable exceptions to this are La Londe & Ellram, Christopher & Braithwaite who take:

(i) a more strategic view, considering more of the total chain and

(ii) a deeper view in considering organisational and technological issues in addition to planning and control issues.

The Industrial Dynamics Work

Industrial dynamics authors such as Towill (1982, 1991, 1992), Edghill et al (1988), Burbidge (1961, 1984), Stalk and Hout (1990) and Coyle (1982) have applied systems control theory of amplification to considering supply chains. Much of the Industrial Theory on which their work is based is attributed to Forrester (1961) and Burbidge (1961).

Forrester's (1961) work considered the production - distribution system whose component echelons were a factory, a warehouse, a distributor and retailers. Between these he simulated flows of goods, information and delays in the system. His effect - **the Forrester effect** - is one where real demand information from the end of the chain can be distorted as it is interpreted, processed and passed up the supply chain. The distortion is amplified the further in the chain a company is from the consumer, as indicated below in figure 4.5:

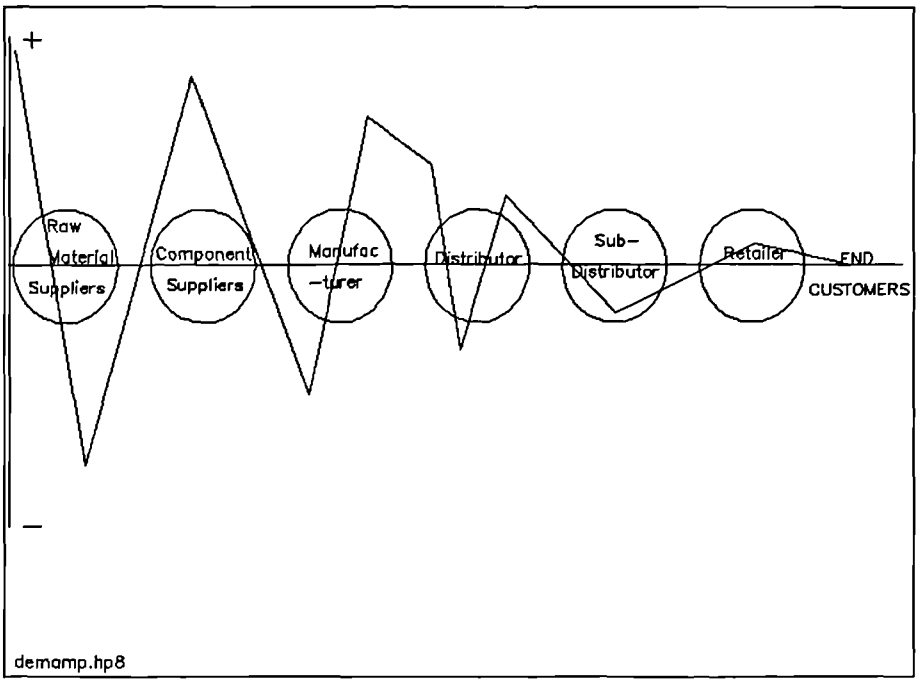


Figure 4.5: Increasing amplification of demand distortion in the supply chain - the Forrester Effect

This principle was developed further by Burbidge (1961) who described the relationship between process flow rate, fluctuations in demand and inventory variation within a manufacturing operation. In 1984, Burbidge used the term **"the Law of Industrial Dynamics"** as being:

> **"If demand for products is transmitted along a series of inventories using stock control ordering, then the demand variation will increase with each transfer"**

The principles of industrial dynamics have been applied in the 1990s to considering the management of supply chains. Central to this is Towill (1991, 1992). Towill (1991) defined a supply chain as having:

"interfaces clearly visible between suppliers / manufacturers, manufacturers / distributors, distributors / customers"

Making reference to **"echelons"** in supply chains, Towill (1992) referred to:

"a number of discrete businesses sequentially adding value during their manufacturing operations"

and therefore considered a broad scope of the supply chain in his definition.

Towill's (1992) focus of attention on supply chain decisions is demonstrated by his definition of **"constituents"** of each echelon in a supply chain:

"Each echelon within a supply chain embraces the following constituents:

(a) Perceived demand for products, which may be firm orders or just sales department forecasts

(b) A production or value-added process

(c) Information on current performance which may be stale or alternatively distorted, or both

(d) Disturbances due to machine / equipment breakdowns etc

(e) Decision points where information is brought together and acted upon

(f) Transmission lags which occur for both value added and other activities

(g) Decision rules (based on company procedures) for changing stock levels, placing new orders etc in light of available information

These constituents demonstrate a focus on hard, Planning and Control issues within the supply chain.

The Industrial Dynamics work does highlight some interesting dynamic features associated with information flows in supply chains. It offers, in the main, hard system explanations by ascribing the effects as being caused by factors including demand volatility, ordering patterns and inventory location decisions.

However, there does not appear to be evidence in the literature of consideration of distortion in the supply chain relating to aspects other than planning and control. As will be shown later in the development of hypotheses for this research, the extension of industrial

dynamics principles to more behavioural issues appears worthy of research.

To conclude the discussion on short term exchange across organisation boundaries, the operations planning and control and logistics literatures have, in the main, provided processes for efficient management of materials in the supply chain, though much of the work has focused on the chain internal to one organisation. The Industrial Dynamics work has contributed a law - the Forrester Effect - (Forrester 1961) to explain volatility within inter-organisational processes.

Locating these literatures in the two dimensional framework below shows their relationship to position in the supply chain.

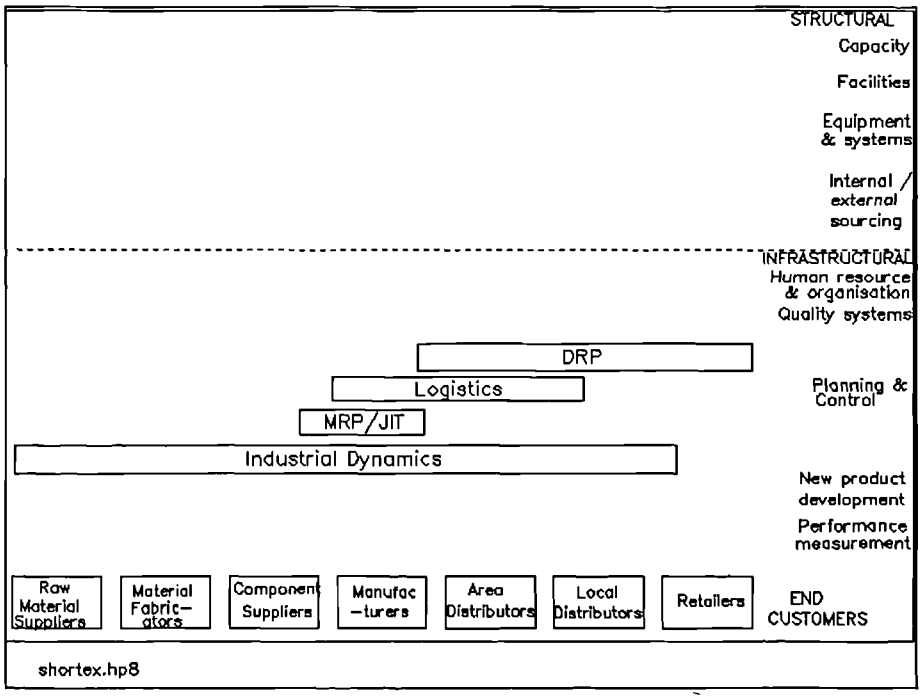


Figure 4.6: Position in chain of short term exchange literature

It can be seen that the industrial dynamics field has provided an integrating concept for the supply chain but, to date, this has only been proven for and applied to volume and timing issues.

Using a further sub-system of the interaction model, the next literature section considers longer term relationships.

LONG TERM RELATIONSHIPS

It has already been established in the previous chapter that longer term, co-operative relationships are increasing in popularity.

Longer term relationships require commitment from the supplier and the customer to an effective relationship providing both parties with a **"win-win situation"** Carlisle and Parker (1989). In longer term co-operative relations the emphasis shifts away from hostile, arms length, negotiation based trading with suppliers to co-operative, mutually supportive effort of customer and supplier to jointly win the end customer's business. Carlisle and Parker stated:

> **"If customer and supplier firms can recognise their common ground in a shared interest in capturing the consumer sale which actually nourishes them both, it**

should be possible for them to work creatively and effectively together to capture that sale for "their" product"

The spectrum of relationship types listed by Child (1987) (discussed from an organisation viewpoint in the previous chapter) will be used here to discuss the elements of exchange in each relationship type of:

(i) Integrated hierarchy
(ii) Semi-hierarchy
(iii) Co-contracting
(iv) Co-ordinated contracting
(v) Co-ordinated revenue links
(vi) Spot networks

Each relationships type will be examined in more detail in this chapter to identify what flows between the parties involved.

(i) Integrated Hierarchy

A vertically integrated firm which houses all activities in the supply chain from raw material source to dispatch to end customer under one roof contains all the primary and support activities on one site as shown below in figure 4.7.

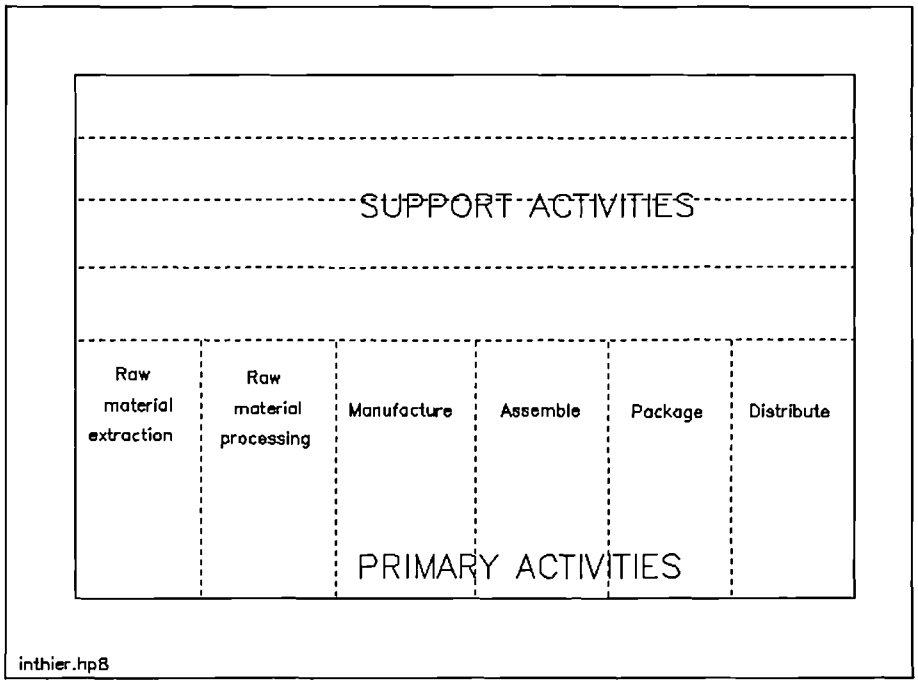


Figure 4.7: Integrated hierarchy organisational form

In an integrated hierarchy there is no inter-company exchange, only an internal supply chain.

(ii) Semi-hierarchy

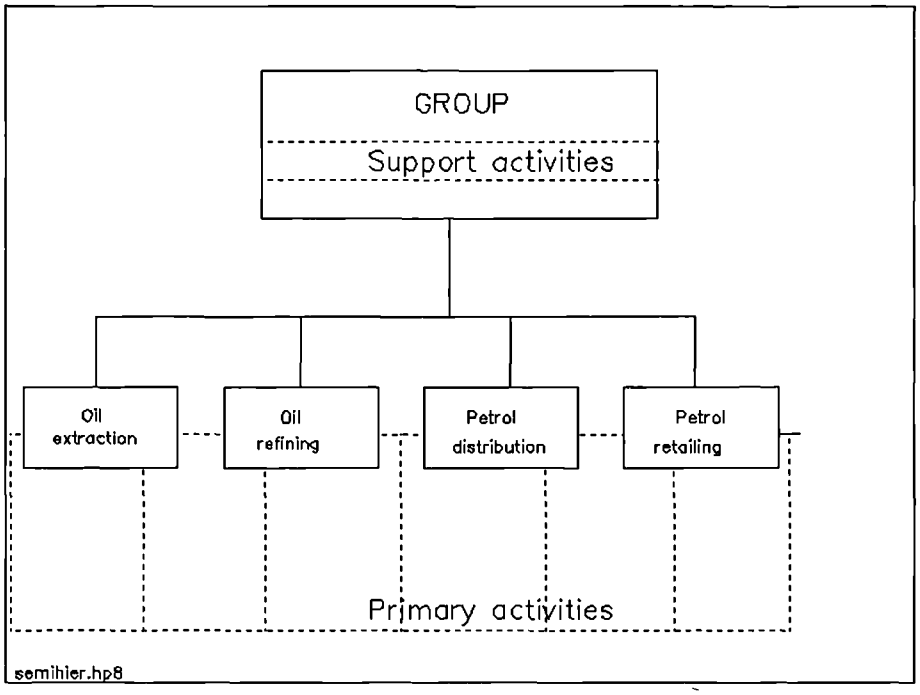


Figure 4.8: Semi-hierarchy organisational form

Here the firms in the supply chain are owned by the same holding company or are part of the same group, but they operate as separate business units, as shown above in figure 4.8.

Both integrated hierarchy and semi-hierarchy are examples of vertical integration as in both cases ownership is by the same firm. However in a semi-hierarchy there is an exchange process between different organisations. In addition to material and information exchange, there is likely to be a common set of systems and technologies exchanged between the parties. People may be exchanged between the organisations for particular projects or on a regular basis, depending on the design of the organisation structure. Benefits of volume contracts may exchange if there is centralised purchasing for the corporation. It can be seen that the network of possible relationships in this organisational form can be complex involving exchange of people, materials, equipment, money and information i.e. all resources.

(iii) Co-contracting

Child (1987) used the term co-contracting to describe long term relations which form between parties who, for various reasons, do not merge but do transfer equity, technology, people and information as well as goods and services. Such alliances are evident in the aerospace and automotive industries (e.g. Airbus Industrie).

The elements of exchange in co-contracting are shown in the figure below:

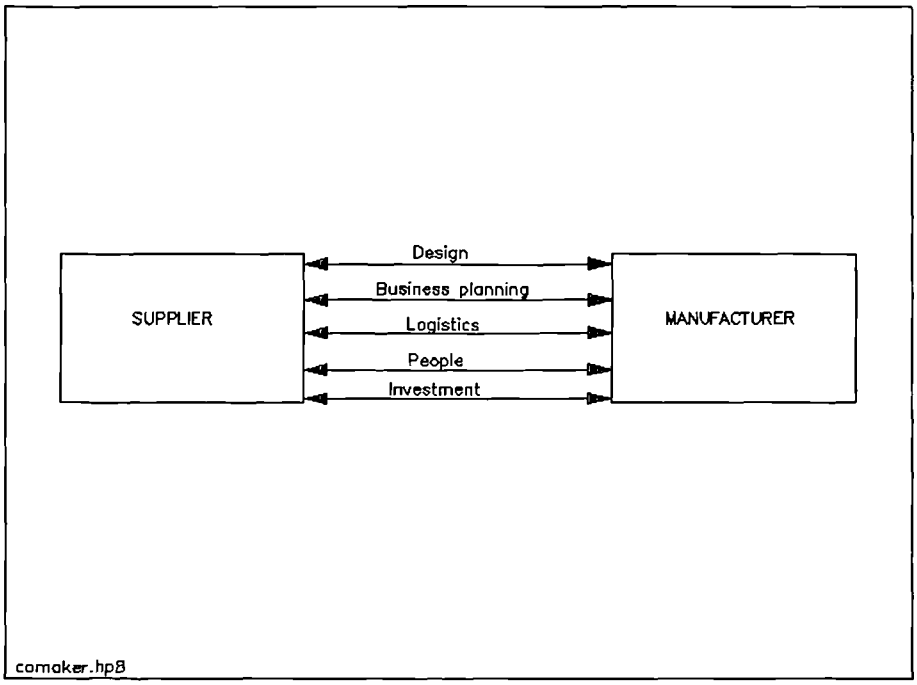


Figure 4.9: Co-contracting as an organisational form

A type of co-contracting receiving significant recent attention is a "partnership". Cousins (1991) defined a partnership as:

> **"the sharing of risks and rewards, of technology and innovation leading to a reduction in costs, improvements in delivery and quality and the creation of sustainable competitive advantage"**

Organisations may enter partnerships with very different intents. One reason is to transfer an activity from one organisation to the partnership because it can be performed more efficiently by the partners together or by the other partner(s) alone. Another reason is to gain

global leadership as it can be viewed that a partnership may provide competitive advantage over an industry leader. Lamming (1993) proposed that the West's perceptions of partnership is based on profitability and cost reduction whereas the partnership philosophy should be based on improving productivity and efficiency.

Lorange and Roos (1992) identified that in partnership, the supplier is a stakeholder in the customer's organisation. Partnership is a long term process and should not be viewed as an instant cost saving exercise but rather as an investment (see Kantner 1989) where future returns are possible but only in the medium to long term.

Partnerships can be with suppliers - these are termed purchasing partnerships - or they may be collaborations with competitors i.e. horizontal partnerships. The purchasing partnership relates to what Contractor and Lorange (1988) referred to as **"vertical quasi integration".**

In this type of relationship, boundaries become **"blurred"**; market relationships are overlaid and replaced with organisational ones (Badaracco, 1992). This often creates close connections between the 2 parties. The partners do not lose their own legal identity, as happens in merger or acquisition. Also they retain their own culture, structure and pursue their own strategies. But

Kanter (1989) argued they reduce their autonomy by strengthening their ties with the other organisation(s).

Central to the work on partnerships and relevant to this issue of a quasi-organisation is the recent work of Lamming (1993). Lamming writes:

> **"the management of lean supply chains may require both collaborators to view the relationship as a 'quasi-firm' with its own organisational structure and goals, communication mechanisms and culture"**

adding that each company has to commit resources outside its organisational boundaries.

(iv) Co-ordinated contracting

Co-ordinated contracting involves a prime contractor, such as a jobbing builder, who employs a set of sub-contractors, such as carpenters, bricklayers, electricians etc., with whom a long standing relationship exists over several contracts. They are used on a contract basis for each specific job. In between jobs there is no continuing relationship.

In co-ordinated contracting the contractor usually provides the specification and instructions for the production of goods and services to be exchanged; he may provide materials and will usually exercise planning and control over all the sub-contractors used. The sub-

contractor will often provide necessary tools and equipment required for their trade or profession.

The elements of exchange in co-ordinated contracting are shown below:

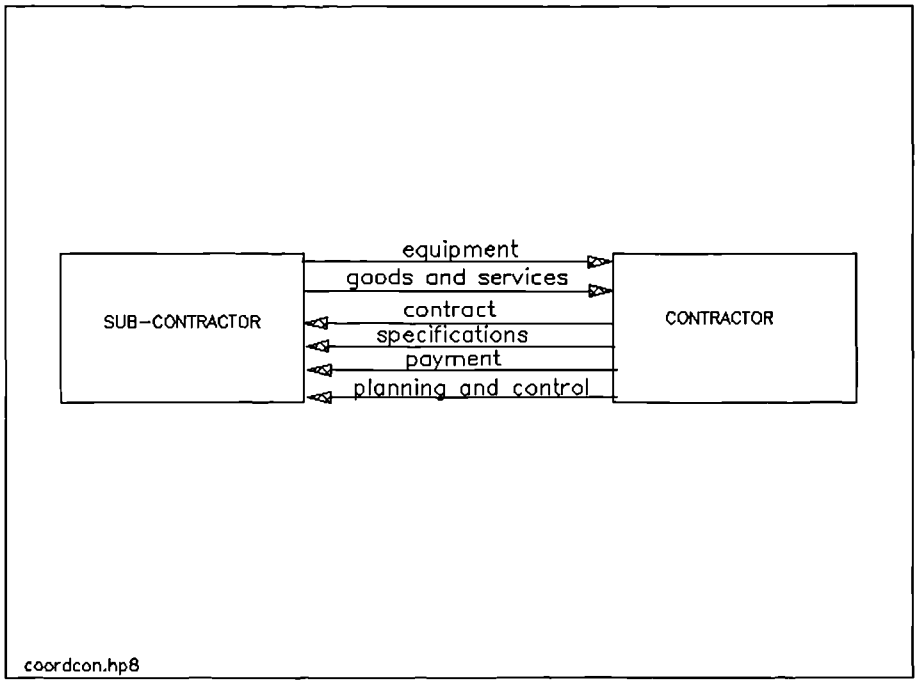


Figure 4.10: Co-ordinated contracting

(v) Co-ordinated revenue links

This category is used primarily for licensing and franchising and is a form of relationship which transfers ownership to other, usually smaller, firms while still retaining a guaranteed income for the licensor or franchisor.

One of the most significant things to pass between parties in this type of relationship is the contract which often specifies:

- property rights to the product / service which usually remain with the licensor / franchisor
- the territory within which the licensee or franchisee can operate
- the product and service specification
- the process specification
- the process of monitoring of performance, and any action that could result from poor performance

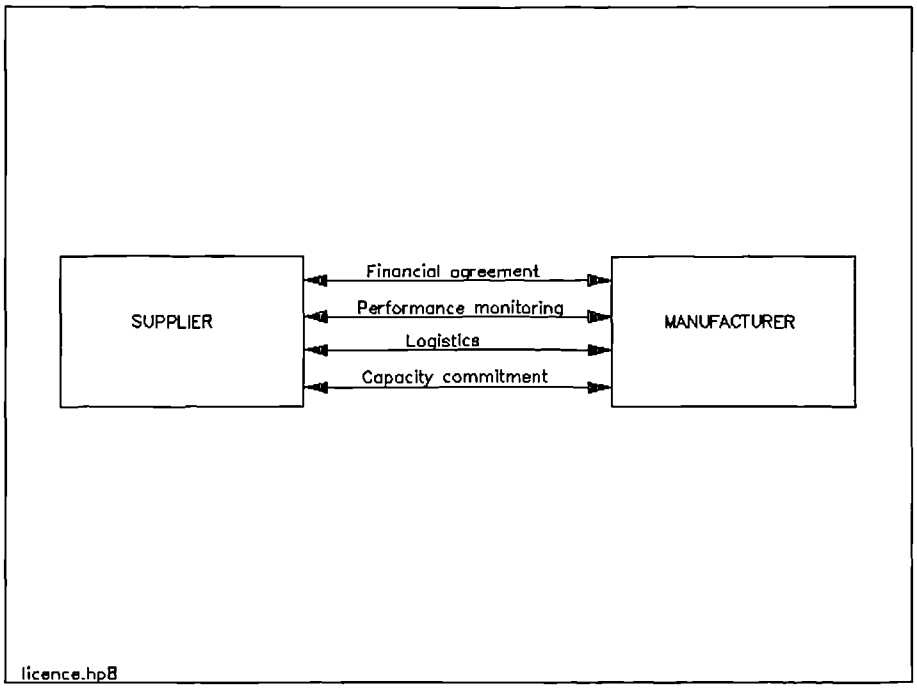


Figure 4.11: Co-ordinated revenue links

(vi) Spot Network

In situations where there is no interdependence beyond one spot order, all that is transferred between the parties to the transaction are the spot order one way and goods and services the other. The agreement is reached after a market search, sometimes competitive tendering and often price negotiation. Once the goods or services are delivered and payment is made, there may be no further trading between the parties. The transfer made in this short term relationship is shown below in figure 4.12.

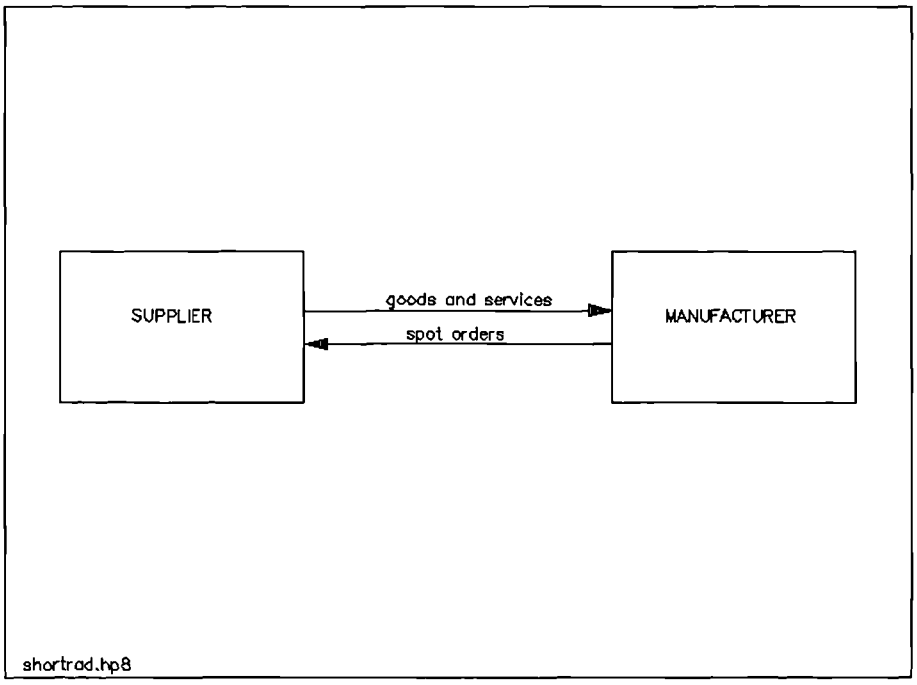


Figure 4.12: Short term or spot transactions

However, if the purchase is for a regularly used item, a blanket order may be used. Approximate annual usage is used to set pricing levels; volumes are called off periodically by use of a delivery schedule. These medium

and long term trading relations are shown below in figure 4.13.

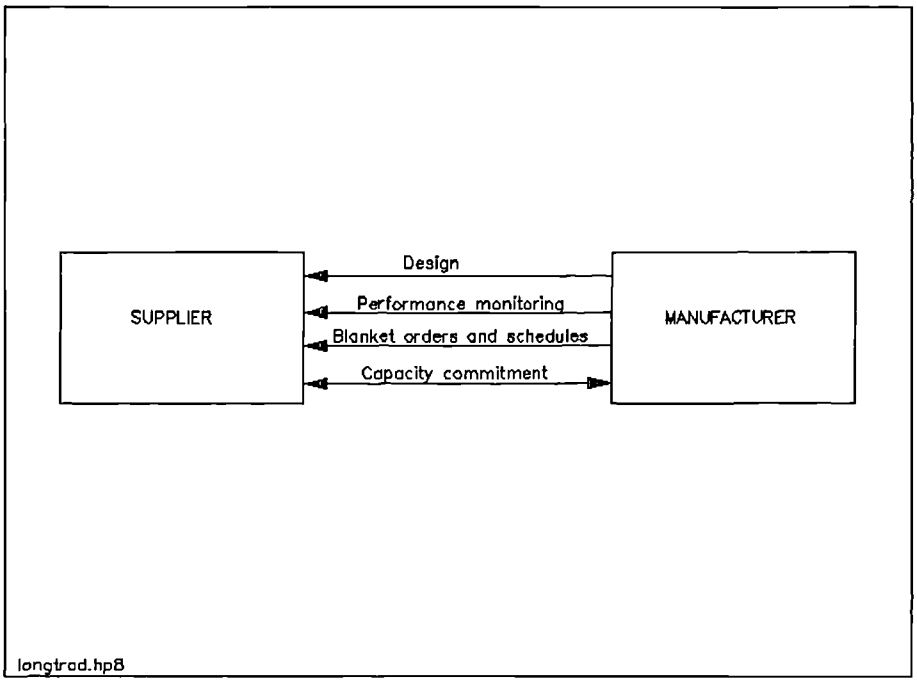


Figure 4.13: Medium and long term trading relations

To conclude the discussion on long term exchange, the literature has provided a structure of different types of relationships and it has been shown here that different things are exchanged, depending on relationship type. The literature therefore considers more strategic and structural aspects of exchange. However, it appears that most of the research to date in longer term relationships has been performed by considering the component manufacturer / assembler relationship. There is less evidence of examination of longer term relationships elsewhere in the supply chain. This is depicted in the 2 dimensional framework below:

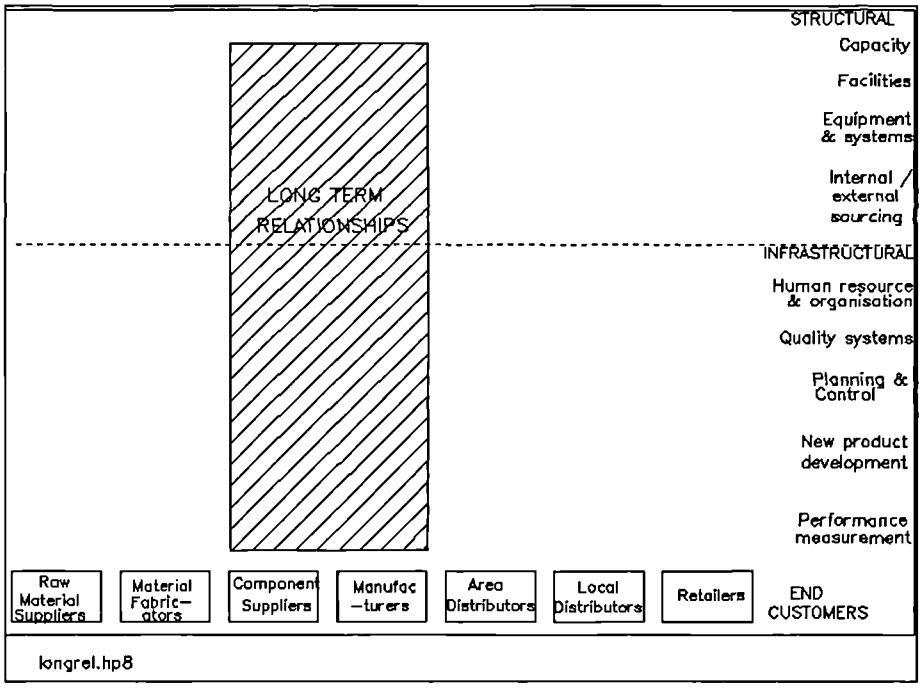


Figure 4.14: Position in chain of long term relationship work

Of the long term relationships, attention is being paid to long term co-operative relationships such as partnerships or comakerships. Less attention is being paid to other, less formalised types of longer term relationships. As there is less evidence of people, system and technology exchange in these less formal relationships compared to, say, comakership, it is reasonable to assume that a different approach may be required to manage exchange within them.

RELATIONSHIP TYPE	EXCHANGE ELEMENTS	EXAMPLES
Integrated hierarchy	People, materials, goods and services, technologies, information, money, equity	Single product firm e.g. paper, aluminium
Semi-hierarchy	People, materials, goods and services, technologies, information, money, equity, centralised control, divisional reporting	Multi-divisional firm, holding company e.g. chemicals, food
Co-contracting	Medium / long term contract, technologies, people, specification,materials, goods, services, knowledge	Co-makership, joint venture e.g. automotive
Co-ordinated contracting	Specification, payment, planning and control information, materials.	Projects e.g. construction
Co-ordinated revenue links	Contract, performance measures, specification of processes and products / services, brand package, facilities, training.	Licensing, franchising e.g. fast food chains
Long term trading commitment	Reservation of future capacity, goods and services, payment, demand information	Single and dual source, blanket order e.g. electronics
Medium term trading commitment	Partial commitment to future work, reservation of capacity, goods and services, specifications	Preferred supplier e.g. defence
Short term trading commitment	Goods and services, payment, order documentation	Spot orders e.g. stationery purchases

Table 4.1: Exchange in different types of relationship

CONCLUSIONS

This chapter has considered short and long term exchange relationships, pre-dominantly from an operations perspective. Table 4.1 above summarises the nature of exchange in different types of relationships, long and short term.

The following conclusions can be drawn.

- Different bodies of work have focused on different decision areas and different parts of the supply chain, as shown below in figure 4.15:

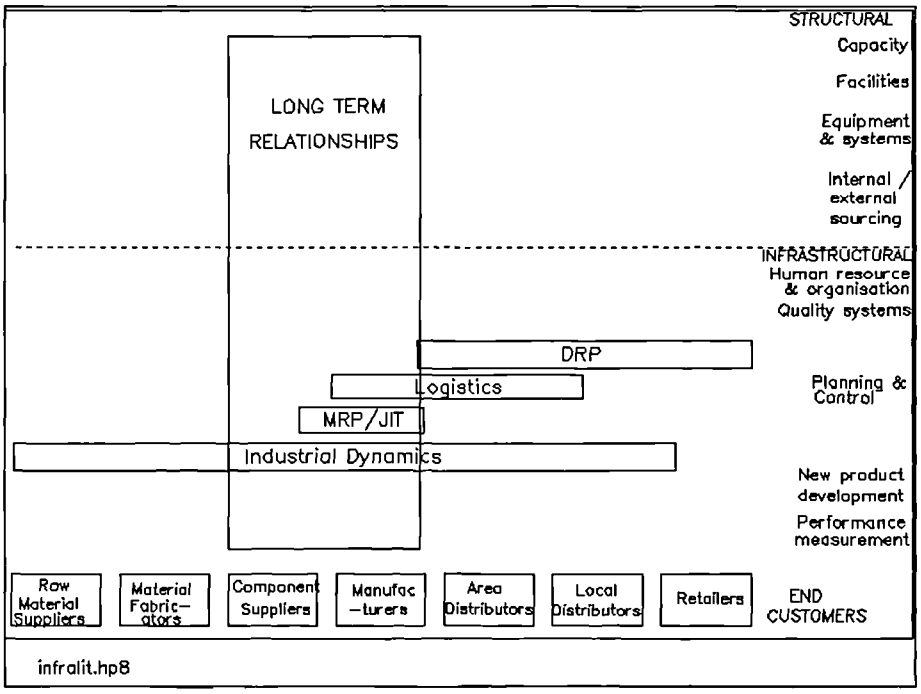


Figure 4.15: Position of short and long term exchange work

- Operations planning and control and logistics have provided processes to manage material and

information. Industrial dynamics has, since the 1960s, provide a conceptual way of understanding and analysing aspects of these processes.

- The logistics literature has tended to focus on distribution of finished goods only i.e. the channel downstream of the manufacturer

- The operations management literature has tended to focus on the supplier / manufacturer dyad in supply chains and has paid less attention to operations management issues in downstream distribution.

- DRP has considered management of distribution predominantly in owned chains.

- The nature of ownership of the goods / services, property rights to those goods and services, and the nature of ownership of resources required to produce those goods and services all affect the exchange process and elements of exchange in relationships

- The nature of the contract including the length of term, the commitment required by both parties, the contractual risk involved for both parties and the degree of formalisation of the contract all affect exchange.

- The more recent work on partnerships and co-operative trading relationships explores the nature of exchange in longer term relationships (i.e. those enduring several years) and with a substantial amount of formalisation of the relationship. There appears to be little work on the nature of exchange in less formal medium to long term trading relationships.

- Further to the previous point, there is evidence of examination of the performance of longer term more formalised relations between firms but not of performance in exchanges in less formalised long term relationships. Without understanding of how to examine these relationships and their relative success, it will not be possible to truly reflect on the success of more formalised agreements such as joint ventures.

The next chapter considers a newly formed body of work - the supply chain management work - which has evolved concepts that integrate the strategic, structural and infrastructural work and specifically develops the work on inter-organisation exchanges.

CHAPTER 5 - SUPPLY CHAIN MANAGEMENT

SUMMARY

This chapter discusses a relatively new concept **Supply Chain Management.** Supply Chain Management has been used to describe management of the value chain. It has also been used to refer to an intermediate organisational form spanning most of the spectrum lying between polar extremes of vertical integration and market transaction. The operations management and logistics definitions of supply chain management have been less strategic and structural in perspective and have focused primarily on planning and control issues as being core to the concept.

Very recently there is evidence of a holistic, more strategic view of supply chain management emerging in various literatures. These holistic views identify the significance of defining who end customers are and understanding their various needs.

It is concluded that supply chain management should be viewed holistically. It is defined for this research as the management of the flow of goods and services to end customers to satisfy their requirements, considering the management of the process, the product / service package (outputs from the process) and the chain resources (inputs to the process). It is therefore defined as **Inter-Organisation Operations Management.**

INTRODUCTION

The first apparent published use of the phrase Supply Chain Management to describe a concept was in 1984 when John Houlihan published a conference paper with this title. At that time he used the phrase to refer to largely infrastructural aspects of managing across company boundaries. However, his later work, discussed in this chapter shows a broader definitional position.

In order to identify the differences and similarities in various authors' definitions of the concept of supply chain management, these will be grouped into structural definitions, infrastructural definitions, and holistic definitions. It will be shown that the holistic definitions can be grouped into those still more oriented towards planning and control, those which take a broad view in term of decision areas but only focus on a 2 party relationship (or dyad) in the supply chain and those which take the broadest view of all, considering breadth of decision making areas and also wide coverage of the supply chain.

Finally in this chapter a definition of supply chain management to be adopted for this research will be stated.

Firstly though the work using the phrase supply chain management which takes a more strategic / structural view will be considered.

STRATEGISTS / STRUCTURALISTS VIEWS OF SUPPLY CHAIN MANAGEMENT

This section identifies the links made in the literature between the strategic / structural view of inter-organisational relationships and the newly emerging concept of supply chain management.

Strategic management authors, notably Porter (1980, 1985 and 1987), Johnston and Lawrence (1988) and Kogut (1985) focused attention on the value chain, linking improved management of value-added activities in a chain of companies with improved output performance and / or improved cost management.

Identifying the association between the value chain and the supply chain, Lamming (1993) writes:

> **"the concept of the supply chain has become popular parlance in recent years. It is generally discussed in the same terms as the value chain - an association which leads to the assumption that the same strategic goals apply to both i.e that the supply chain can be optimised so that value can be added at minimum cost for each stage."**

Adopting a value chain definition of supply chain management leads to a financially oriented analysis of the chain. As Lamming describes above, a chain can be broken down into stages and each stage value analysed.

Using Porter's chain of activities, each primary activity involved in the flow of value added can be analysed to identify ways of reducing cost or improving benefit.

In addition to the value chain work, supply chain has been discussed in terms of industrial organisation theory.

Chapter 3 identified that industrial economists, notably Coase (1937), Richardson (1972), Blois (1972) and Williamson (1975, 1985 and 1986) identified a spectrum of type of relationship which organisations can have with each other. Williamson linked this market structure to market conduct and market performance.

A recent piece of work taking this strategic / structural perspective and considering the definition of supply chain management in its context is by Ellram (1991b). Ellram defined supply chain management as an intermediate market form, as shown in figure 5.1 below:

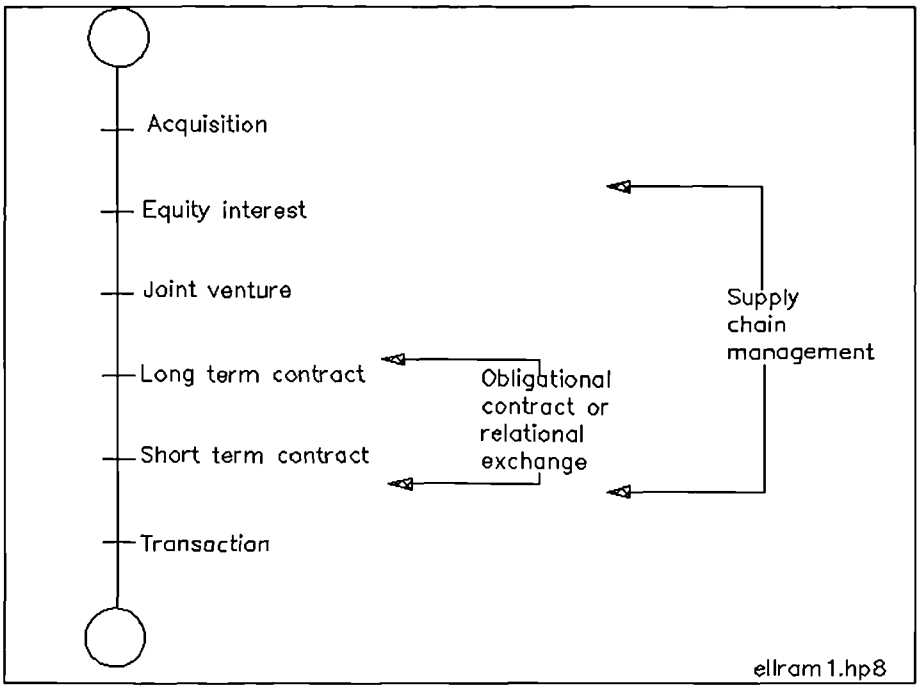


Figure 5.1: Supply chain management as a type of competitive relationships. Source Ellram L (1991b)

She expressed the view that supply chain management represented an alternative to vertical integration, stating that:

> **"Supply Chain Management is simply a different way of competing in the market"**

Christopher (1992) also saw supply chain management as an alternative to vertical integration. He differentiated between supply chain management and vertical integration by saying:

> **"Supply chain management is not the same as vertical integration. Vertical integration normally implies**

ownership of upstream suppliers and downstream customers"

thereby implying that supply chain management does not imply ownership.

Considering both Ellram's and Christopher's definition, supply chain management emerges as a term to cover the middle of the spectrum of relationship types. This appears a retrograde step in knowledge building; other authors, for example Child 1987, are expanding the number of categories. With the emergence of new types of relationship such as comakership and licensing, more categories would appear beneficial. Supply chain management as an intermediate market form makes it what Williamson (1975) originally termed "relational exchange".

In the same paper, Ellram defined supply chain management as:

"an integrative approach to dealing with the planning and control of the materials flow from suppliers to end users"

Ellram's does not adequately bridge the gap between supply chain management being a new organisational form and an approach to planning and control. These 2 contrasting definitions are difficult to rationalise;

organisational forms encompass all aspects of management, not just planning and control.

These strategic and structural definitions of supply chain management as (i) management of the value chain and (ii) an intermediate organisational form add little to existing knowledge. Management of the value chain is already a well accepted concept as is the notion of intermediate organisational forms.

The next section explores the definitions of supply chain management which are more infrastructural in viewpoint.

INFRASTRUCTURALIST VIEWS OF SUPPLY CHAIN MANAGEMENT

Jones and Riley (1985) conceptualise supply chain management as the management of a series of inventories connected by orders, as shown below in figure 5.2:

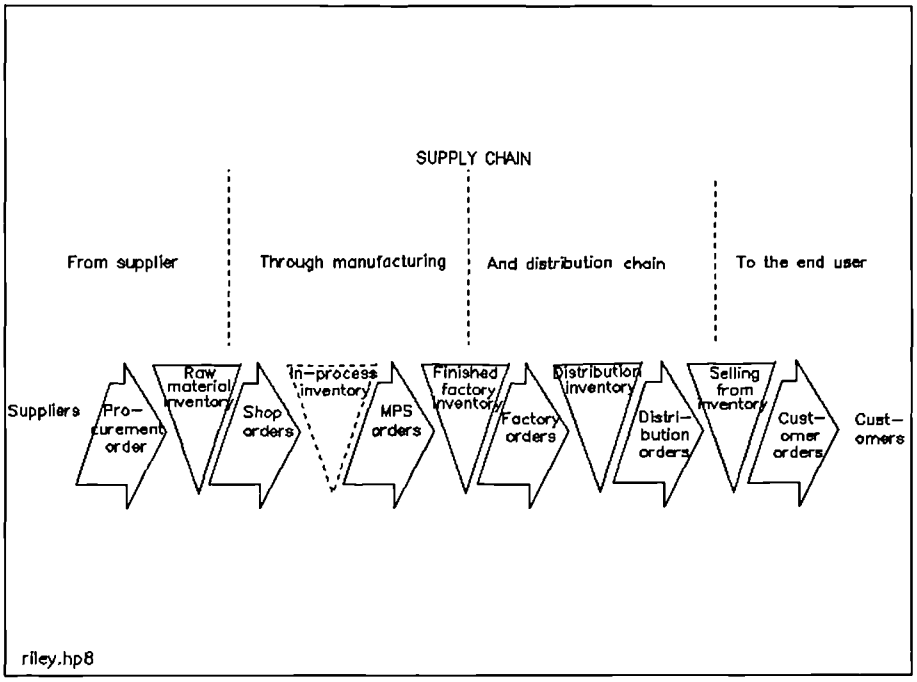


Figure 5.2: Inventory management view of planning and control Source Jones and Riley (1985)

They define supply chain management thus:

> **"Supply Chain Management techniques deal with the planning and control of total materials flow from suppliers through end-users".**

This work specifically identifies the significance of considering end customers and their differing needs for **"time and place utility (item availability, delivery response time).** They propose that these end customers' needs could be grouped into segments, with examples provided on differing segment needs - segment A may require a high service level, be willing to pay a premium for high service and would find low or moderate service unacceptable whereas segment B may require a low service

level, be willing to pay a modest premium for better service but not willing to pay for a high level of service. They highlighted that in addition to the problems of failing to provide high enough service levels to segments which demanded them, there were also likely to be some segments which were **"over-served"**. They recommended that modified offerings to each channel should be made dependent on service level needs.

Jones & Riley identify that providing higher levels of service to specific segments will increase resource costs relating to inventory, transportation, facilities and people resources, but that adoption of an integrated approach to managing inventory across organisational boundaries will help to lower these resource costs. This integration across organisational boundaries will require **"necessary policies, organisational relationships, systems and controls".**

For effective supply chain management, Jones and Riley identified **"three elements that must come together for integrating the supply chain to operate effectively:**

(i) recognising end-user customer service level requirements

(ii) defining where to position inventories along the supply chain and how much to stock at each point

(iii) developing the appropriate policies and procedures for managing the supply chain as a single entity"

They identify that in the part of the supply chain which is captive to the manufacturer, the functional conflicts between procurement, manufacturing, production control and distribution management will act as barriers to supply chain management. Further barriers are raised by independent vendors and distributors in the supply chain; they identify that when managing supply chains involving independent organisations, the key is to establish **"mutually advantageous relationships to make the supply chain work more smoothly and at lower costs. The tools available to work with are volume, price, commitment horizon, schedule stability and exclusivity of franchise".**

Therefore, it can be seen that, from Jones & Riley's viewpoint, supply chain management emerges as a strategic, customer oriented approach to inter-organisational inventory management.

Another view of supply chain management as inter-organisational inventory management was given by Barnes (1987) who provided a service example of supply chain management in health care. From the materials manager's viewpoint he discussed provision of **"goods and services**

for a cost-conscious delivery system" from materials suppliers, through health care providers to customers. The main aim of the discussion focused on optimising inventory management in the chain.

Christopher (1992) defined the supply chain as:

> **"The supply chain is the network of organisations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer. Thus, for example a shirt manufacturer is a part of a supply chain that extends upstream through the weavers of fabrics to the manufacturers of fibres, and downstream through distributors and retailers to the final consumer"**

Putting in context the definitions of logistics and supply chain management, Christopher writes that supply chain management is:

> **"no more than an extension of the logic of logistics".**

He describes logistics as:

> **"primarily concerned with optimising flows within the organisation"**

whereas supply chain management extends beyond this to suppliers and customers.

However, later in the same work he states:

> **"One of the most significant business trends of the late 20th century has been the emergence of logistics as an integrated concept spanning the entire supply chain from raw material through to the point of consumption"**

In addition, Christopher used the example of Nissan to clarify the definition saying:

> **"Nissan manage the total material flow, from component source to final car, as a single system".**

It appears from these definitions that Christopher's view of supply chain management is one of a value added chain, an inter-organisational logistics concept to manage flow through the chain. Adding these to his definition provided earlier that supply chain management is an alternative to vertical integration gives a broad, unfocused view of what supply chain management is. It could be argued that his definitions imply that supply chain management, as inter-organisation logistics, creates an organisational form other than vertical integration. This may be the definition behind Ellram's (1991b) paper.

Some common ground does appear to emerge. It would appear that the structural and infrastructural definitions of supply chain management agree that the organisations in

the chain being managed do not have to be owned by the same company. The apparent differences in definition may be ascribed to different perspectives - supply chain management is either an alternative organisational form to vertical integration which requires planning and control techniques to administer or supply chain management is a set of planning and control techniques which can be used in chains which are not wholly owned, thereby giving rise to an organisational form. The end result is not too dissimilar.

However, a significant difference in definitions of supply chain management emerges when the works of other authors, particularly Houlihan (1984, 1987, 1988, 1989a, 1989b and 1989c), Lamming (1987, 1989 and 1993) Womack et al (1990) Harland (Jones) (1989, 1990, 1993) and Stevens (1989) are considered in more detail. These authors have tended to adopt a broader, more holistic view of management across organisational boundaries.

HOLISTIC DEFINITIONS OF SUPPLY CHAIN MANAGEMENT

The definitional work on supply chain management is still evolving; when it was first used in the mid-1980s there is no evidence that a holistic approach was taken at that time. However, authors such as John Houlihan (1984, 1987, 1988, 1989a and 1989b) have shifted their definitional stance over time to take a more holistic view in their later work.

In 1984 Houlihan was the first to publish a paper using the term of supply chain management to represent a concept. Houlihan's (1984) definition was:

> **"Supply Chain Management differs significantly from classic materials and manufacturing control in four respects. First it views the supply chain as a single entity rather than relegating fragmented responsibility for various segments in the supply chain to functional areas such as purchasing, manufacturing, distribution and sales. The second distinctive feature of supply chain management flows directly from the first; it calls for - and, in the end, depends upon - strategic decision making. "Supply" is a shared objective of practically every function in the chain and is of particular strategic significance because of its impact on overall costs and market share. Third, supply chain management provides a different perspective on inventories,**

which are used as a balancing mechanism of last, not first, resort. Finally, supply chain management requires a new approach to systems; integration, not simply interface, is the key.

The definition above makes reference in the first point to organisation structure, in the third to planning and control and in the fourth to systems integration. However, defining supply chain management by comparing it to **"classic materials and manufacturing control"** indicates an orientation more towards planning and control than to other decision areas in an organisation.

Regarding the coverage of the supply chain in Houlihan's early definition, his representation of the supply chain shown below in figure 5.3 clarifies this; it appears to relate pre-dominantly to an internal supply chain plus suppliers at one end and distribution channels and the **"end user"** at the other.

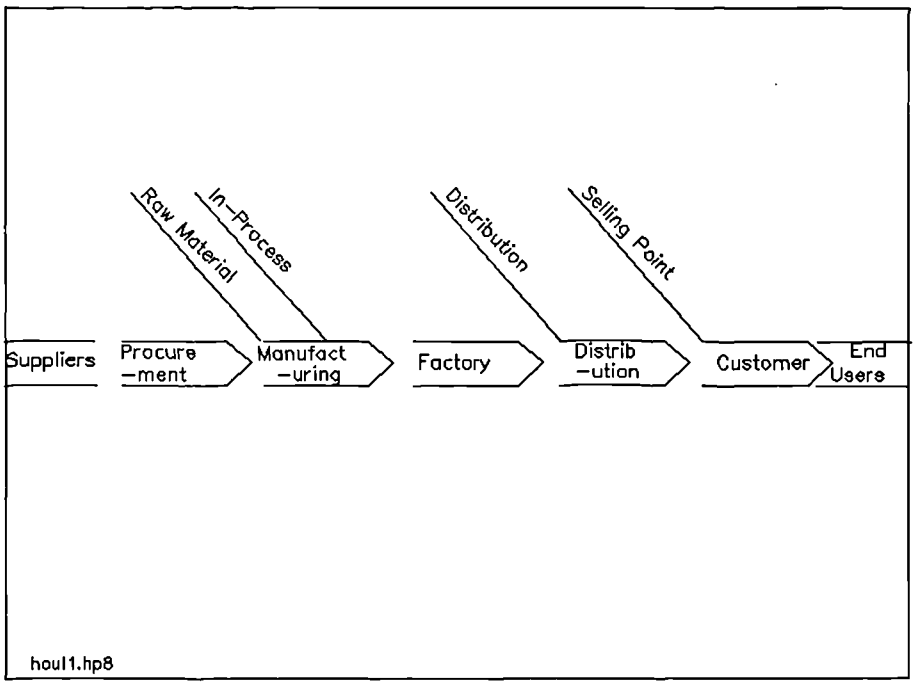


Figure 5.3: **Supply Chain Management** Source: Houlihan 1984

When considering the upstream part of the supply chain, Houlihan discusses co-makership and the significance of zero defects in the chain, highlighting that co-makership requires more support than merely transaction handling systems - rather they require:

> **"effective policy, planning and organisation"**

and:

> **"a new relationship: business to business, rather than purchasing to selling"**

Whilst not explicitly stating in the paper whether inter-company operations are being considered or whether the supply chain is internal to one firm, Houlihan discusses the conflicting nature of the **functions** of marketing, sales, manufacturing and distribution stating:

> **"some companies tend to resist the notion that a better balance** (between cross functional strategies) **can indeed be achieved, claiming to be victims of their own structures"**

and considering:

> **"integration of the various systems throughout the organisation's supply chain"**

The use of the word **"own"** and the phrase **"organisation's supply chain"** indicates that a single company supply chain is being discussed.

In a later paper, Houlihan (1987) discussed a broader span of decision areas than in the previous paper. He discussed the relationship between service, capacity management and inventory referring to these three as **"the currency of balance"** in the supply chain. In addition the importance of integration of the following was emphasised:

- **"o management of data capture and flow across the functional boundaries**

- **o linking systems for purchasing, production and inventory control, distribution, order entry and service**

- **shared ownership of information and a high degree of visibility across all functions of plans, allocations, inventories and customer**

However, these are still essentially planning and control oriented activities; certainly there is no orientation towards design type decisions in the paper.

Regarding the scope of coverage of the supply chain, Houlihan distinguishes between

(i) the **"single organisational unit"** supply chain or the **"internal supply system"**

(ii) the **"international supply chain"**

(iii) and the **"global supply chain".**

The internal supply chain refers to the supply chain discussed in his previous paper. This 1987 paper, however, considers the case of a company which operates over international boundaries and manages **"within one corporate entity"** its own supply chain across different territories each with their own cultures and systems. He proposes that the international company is more vulnerable than the local producer to the effects of demand distortion in supply chains. He also states that:

"planning and allocating capacities across country boundaries becomes more complex"

Discussing then a larger system than the international supply chain, Houlihan recommends consideration of the company's **"context of its external placement in a global supply chain"**. This global supply chain is represented below in figure 5.4 and clearly distinguishes between different companies.

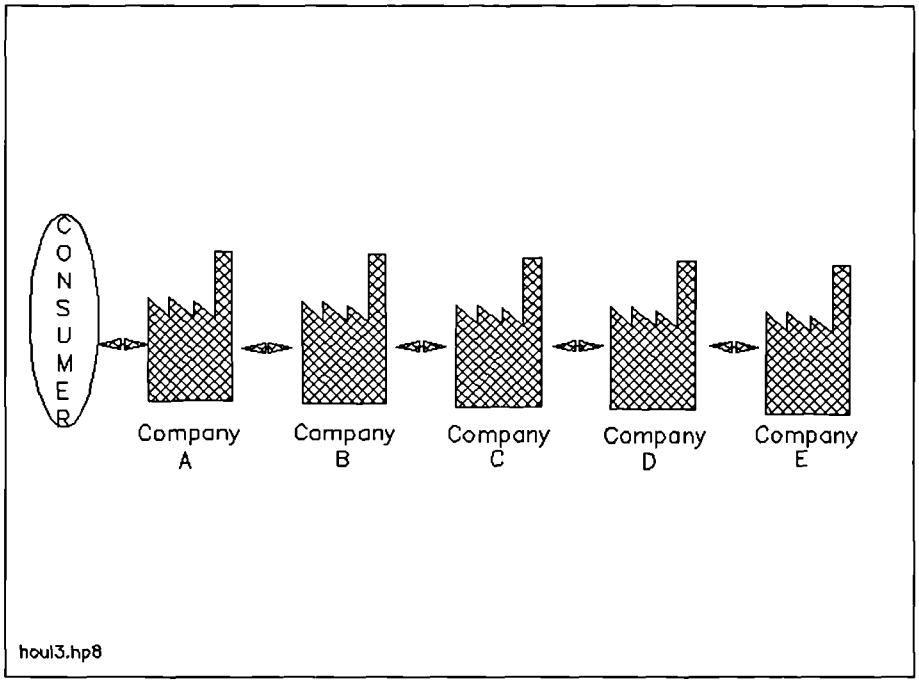


Figure 5.4: Global supply chain Source Houlihan 1987

It would appear therefore in this work that management of the supply chain still refers to management of activities under one corporate entity i.e. a vertically integrated chain, albeit on different international sites, but that the **context** of the inter-company supply chain should be considered. There is no suggestion that this global or

inter-company supply chain of different companies should, or could, be managed.

Three later papers (Houlihan 1989a 1989b and 1989c) add little to the definition of supply chain management, except in terms of the decision areas covered, by highlighting the significance of the human issues in supply chains saying:

> **"in most companies the main hurdle is to step up to the issues in organisation, human resources, policies and systems and to break down traditional attitudes".**

He further supports this by listing as a supply chain imperative:

> **"integration with the internal (computer integrated) business system through use of more subtle and effective organisation policies"**

Houlihan's work, therefore, appears to recognise the significance of decisions in the areas of capacity, facilities, technology, workforce, planning and control and organisation but focuses attention on the planning and control areas.

Houlihan is a business consultant and his work does not provide evidence of any support from empirical research.

His contribution appears to be in the generation of ideas and the core of a concept of supply chain management.

Another business consultant - Stevens (1989) - adopted a process definition of a supply chain describing it in terms of a:

> **"connected series of activities which is concerned with planning, co-ordinating and controlling material, parts and finished goods from suppliers to the customer."**

This definition is focused on operations planning and control activities, as is his statement of the objective of supply chain management:

> **"The objective of managing the supply chain is to synchronise the requirements of the customer with the flow of material from suppliers in order to effect a balance between what are often seen as the conflicting goals of high customer service, low inventory investment and low unit cost."**

However, Stevens expands the focus beyond the planning and control issues by further stating:

> **"It** [the supply chain] **extends much further than simply a concern with the physical movement of material and is just as much concerned with supplier**

> **management, purchasing, materials management, manufacturing management, facilities planning, customer service and information flow as with transport and physical distribution"**

Regarding facilities planning, Stevens suggests that, amongst other issues, strategic development in supply chains should consider key facilities and their locations. Regarding supply chain organisation, Stevens proposes that strategic focus is required to develop an

> **"organisation structure able to bridge functional barriers".**

Further support of Steven's definition of supply chain management extending beyond planning and control is provided when he discusses development of an integrated supply chain as involving co-ordination and harmonisation of the use of facilities, people, finance and systems.

When defining what he termed the **"scope of the supply chain"**, Stevens said **"it begins with the source of supply and ends at the point of consumption".**

Stevens provides a 4 stage model of the evolution of integration in the supply chain; this is shown below in figure 5.5.

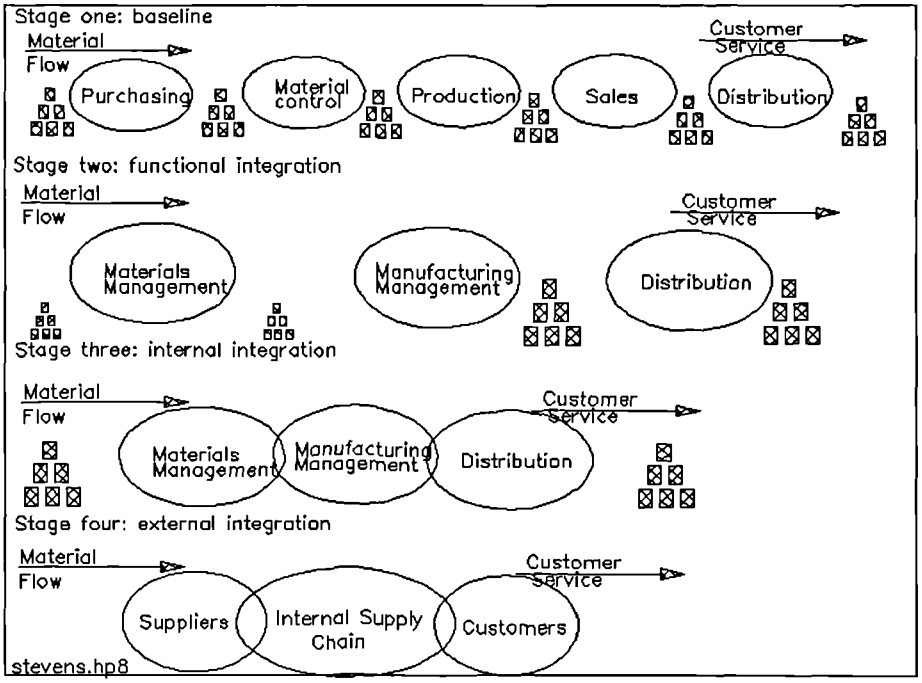


Figure 5.5: Evolutionary stages of supply chain management: Source Stevens (1989)

As can be seen above, Stevens differentiates between the internal supply chain (encompassing purchasing, material control, production, sales and distribution activities) and external integration, integrating the internal supply chain with immediate customers and immediate suppliers. When he uses the term **"company"** he implicitly refers to a manufacturer. The terms **"customer market"** and **"consumption"** are used by Stevens to refer to the customer purchasing from the company, or manufacturer.

It can be seen therefore that Houlihan and Stevens, while acknowledging management of decision areas beyond planning and control, have still focused most attention on the planning and control aspects of supply chain management.

The definitions of a group of authors who have considered breadth in terms of decision areas but have only focused attention on a two party relationship, or dyad, will now be considered.

The Supply Chain Management Group who started at Glasgow Business School (Macbeth 1987 and Macbeth et al 1989a, 1989b, 1990a and 1990b) define Supply Chain Management in terms of the relationship with immediate suppliers. The main focus of their work is on types of relationship between manufacturers and component suppliers. One of the outputs of their work is a **"positioning tool"** to consider how certain factors may be optimised in a customer/ supplier relationship.

Whilst not specifically using the term supply chain management, Carlisle and Parker (1989) also focus on customer-supplier relationships. They consider broad aspects of these relationships but have not extended them beyond the dyad i.e. the two party relationship. Other authors on customer / supplier relationships such as Stuart (1993), Campbell (1985) and Dwyer et al (1987) have also focused attention on one dyadic link, usually the component manufacturer / assembler relationship.

The relationship literature, therefore, can be seen to be limited in scope in terms of the extent of the supply chain considered, but deep in terms of the coverage of decision making areas.

There are, however, a small number of authors who have taken an even broader and deeper perspective of supply chain management; their definitions will now be considered.

The lean production / lean supply authors, notably Womack, Jones & Roos (1990), Nishiguchi (1987 and 1994) and Lamming (1987, 1989 and 1993) whose work originated from the IMVP program at MIT, have taken a broader view of the opportunities of managing across organisational boundaries.

Womack et al (1990) and Nishiguchi (1987 and 1994) describe the upstream supply network in Japanese lean production systems which are in tiers. An automotive manufacturer deals with first tier suppliers who deal with a teams of second tier suppliers who **"may, in turn, engage helpers in a third or even fourth tier of the supply pyramid".**

Whilst in their concept of lean production they describe the downstream distribution network right down to the consumer, through a dealer network, their definition of the supply chain relates to the network upstream of the manufacturer. Their view is broad in terms of the decision areas addressed, discussing aspects of capacity, equipment and systems, technology, sourcing, human

resources, quality, planning and control, new product development and performance measurement.

Central to the work which develops the lean production / lean supply concept and addresses supply chain management is Lamming (1987, 1989, 1993). Lamming (1993) defined supply chain management in the context of relationships, as demonstrated below:

> **"Extension of the relationship concept invokes the subject of "supply chain management"... and "pipeline management". They are basically sub-sets of logistics, concerned with optimising the whole value chain through balancing, resource auditing and relationship monitoring"**

and

> **"Viewed broadly, the supply chain management concept can be seen as part of networking"**

and

> **"Supply chain management must also be considered... The manner in which the customer becomes involved in suppliers' suppliers is connected to the relationship between buyer and supplier...it is deemed to lie outside the individual link"**

It would appear that Lamming, Womack et al and Nishiguchi endorse the opportunities of management of a broad set of decision areas across organisational boundaries; their term of **"lean supply"** covers this from the manufacturer

upstream in the supply network. It would appear that lean supply is different to their view of supply chain management which refers to a narrower, logistics oriented set of decisions, again in the upstream supply network.

When considering the extent of the supply chain covered by Lamming's definition, his depiction of **"the structure of the supply chain"** indicates that his work focuses on the chain from the manufacturer upstream.

Jones (Harland) (1989) defined supply chain management as

> **"managing the entire chain of raw material supply, manufacture, assembly and distribution to the end customer"**

and in Harrison and Jones (Harland) (1990) as:

> **"the management of all or some of the businesses that add value to the goods and services ultimately received by the end customer"**

Both these definitions have a broad scope in terms of the extent of the supply chain covered.

Regarding the decision areas considered in the definition, the following indicates the depth of coverage:

> **"Supply chain management has been associated with, primarily, the flow of orders and materials through**

the chain i.e. predominantly a logistics view. However, there are other important features valued by end customers that are beyond the logistics arena...It is important therefore that the supply chain is managed to provide all the features that end customers require, not just volume and timing related features"

The focus on the importance of end customer requirements and on the breadth and depth of coverage of the definition of supply chain management are distinctive features of Jones (Harland)'s definition.

A later definition in Jones (Harland), Williams and Fitzgerald (1993) more explicitly stressed the importance of consideration of end customers.

"Supply chain management is defined here as the management of the flow of goods and services to end customers to satisfy their requirements"

It also more explicitly emphasised the depth of coverage of decision areas considered by supply chain management.

"The end customer perspective adopted here includes consideration of the management of the process, the management of the product / service package (the outputs of the process) and the management of the chain resources (the inputs to the process); all

these are considered in terms of their contribution to end customer satisfaction."

Harland's broader, holistic view was adopted by Slack (1991) who distinguished between the internal supply network, the immediate supply network and the total supply network, as shown below in figure 5.6.

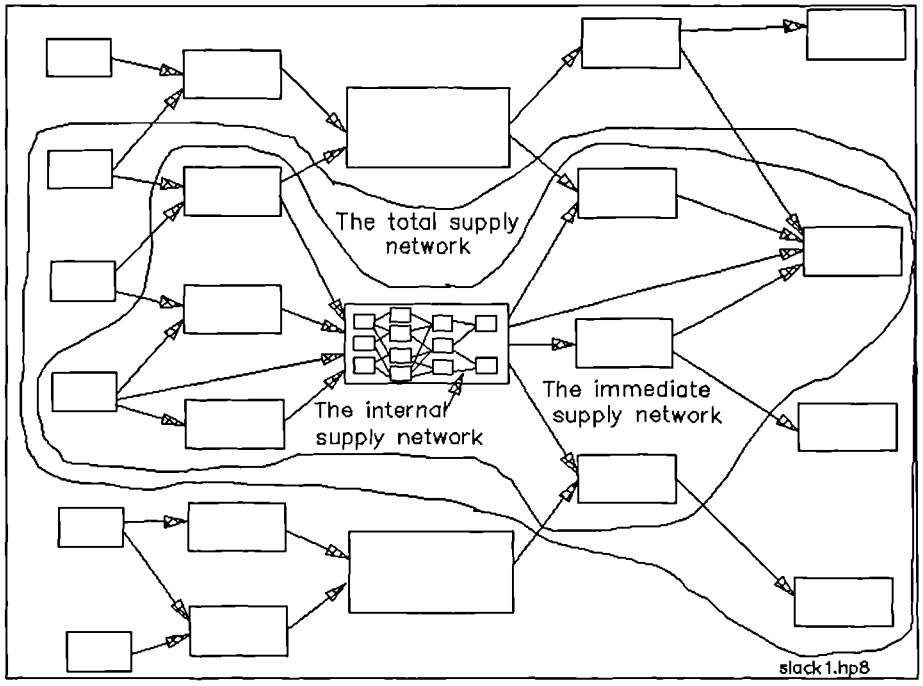


Figure 5.6: Supply networks: Source Slack (1991)

He defined the internal network as the:

"flows of materials and information between departments, cells or sections of the operation"

the immediate network as including the first tier suppliers and customers which a firm deals with directly

and the total network as going beyond this to the suppliers' suppliers and the customers' customers.

Basing the discussion largely on Jones (Harland) (1990), Slack summarised the benefits of taking this holistic view as being:

- It puts the operation in its competitive context
- It helps identify the key players
- It shifts emphasis from short term opportunism to long-term profitability
- It avoids local fixes
- It sensitizes operations to macro changes

It would appear, therefore, that there are differences between even the more holistic views of supply chain management. However, underlying common ground can be identified. Management of supply chains is about managing connected sets of relationships between chain players. These necessarily form networks. These networks will represent different types of market form, depending on the types of relationships contained in them.

This common ground puts all the various views of supply chain management into perspective; it is all about level of analysis. In the same way that an individual is an operation that requires managing, as is a cell, a department or a factory, so too can supply chain management be viewed in terms of relationships, chains

and networks. Broader still, networks operate in industries made up of competing and collaborating networks.

To date there has been little co-ordination of these different levels of analysis of supply chain management. The subject area lacks conceptual frameworks within which to locate work to enable comparison.

From the above discussion, the following conclusions can be drawn.

CONCLUSIONS

- Supply chain management has only been identified as a concept using this term since the early to mid 1980s

- There is no agreement emerging as yet as to precisely what supply chain management encompasses in terms of (i) the set of decision areas it includes and (ii) which part of the chain from original raw material source to ultimate consumer it refers to

- It appears that much of the literature views supply chain management as a concept and set of techniques to manage across organisation boundaries which does not necessarily involve ownership

- There are three significant bodies of work which define supply chain management quite differently i.e. the chain planning and control oriented work, the dyad relationship broad decision area, performance oriented work and the broad views are expressed in the lean production / lean supply work and by Harland. These are depicted below in figure 5.7.

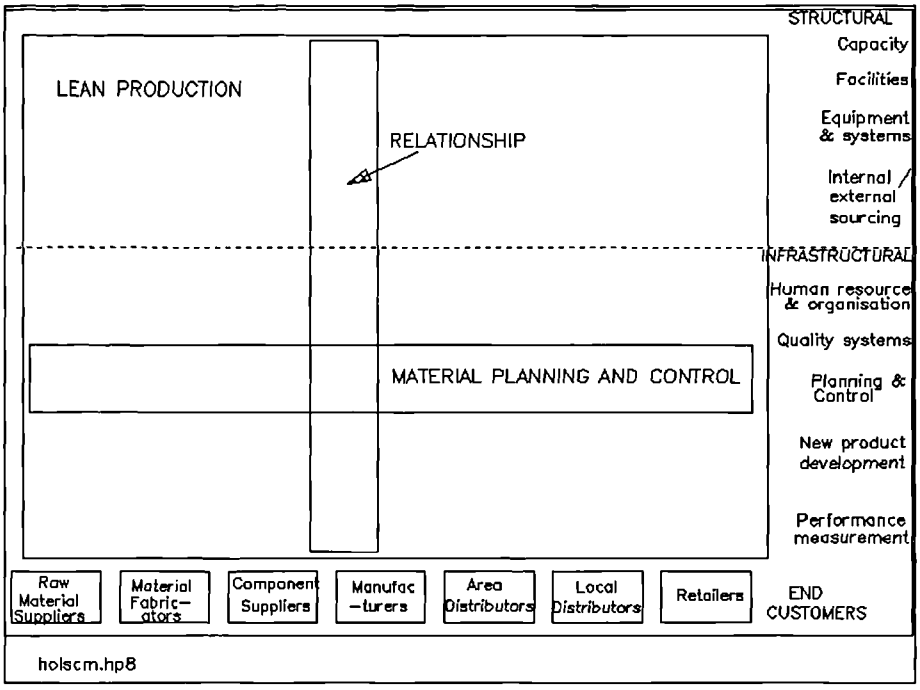


Figure 5.7: Groupings of work on supply chain management

- Whilst much of the earlier work focused on **efficiency** in supply chains to reduce cost, there is some more recent agreement that supply chains should be managed to serve end customers more effectively

- For this piece of research the broader, end customer oriented definition of supply chain management from Harland et al (1993) will be adopted.

  "Supply chain management is defined here as the management of the flow of goods and services to end customers to satisfy their requirements"

  "The end customer perspective adopted here includes consideration of the management of the process, the management of the product / service package (the outputs of the process) and the management of the chain resources (the inputs to the process); all these are considered in terms of their contribution to end customer satisfaction."

  i.e. Supply Chain Management is defined as being **Inter-Organisation Operations Management**

As was identified in Chapter 1, Operations Management is becoming more external performance oriented; it is therefore reasonable to extend this trend to Inter-Organisation Operations Management, or Supply Chain Management as it is being defined here.

The next chapter deals with the issue of performance to identify, if an external performance oriented view of supply chain management is to be taken, how that

performance should be defined and how it could be measured.

CHAPTER 6 - MEASURING EXTERNAL PERFORMANCE

SUMMARY

This chapter highlights the increasing need to understand and measure performance recognised by the strategic management and accounting literatures. Further, that these literatures have identified the significance of operational performance.

Operational performance is considered, discussing further the movement away from internally oriented measures to more externally, customer oriented measures. This customer perspective is further explored to highlight appropriate dimensions of performance which have this external, customer orientation. The main bodies of literature providing debate on appropriate dimensions of output performance reviewed here are the operations management, operations strategy, service management and purchasing literatures which identify hard rational variables and softer variables of output performance.

The process of measuring performance is considered, identifying 3 key issues: (i) that customers' **expectations** along each dimension may vary, (ii) that customers' **perceptions** of performance against each dimension may vary and (iii) that the link between expectations, perceptions and customers' satisfaction / dissatisfaction is complex. This discussion is linked to **expectancy disconfirmation theory**. It is concluded that (i) a clear view of expectations is required (ii) that an understanding of perception of performance is required and that (iii) a longer term view rather than a short term transaction view of performance is required if the performance information is to be used for indications of possible repeat purchase.

Having identified the hard and soft dimensions of performance and the key issues in measuring performance, the next section reviews hard and soft performance measurement systems. The hard systems reviewed include categorical, weighted points and cost ratio plans from the purchasing literature and more recent work on measurement systems to evaluate longer term relationships. It is concluded that the purchasing literature generally has assumed a rational, negotiated relationship between suppliers and customers, focusing pre-dominantly on a short term transaction perspective of performance. The soft approaches to performance measurement, mainly from the service management literature, do not assume that relationships are rational and, rather, that "performance" results from a comparison of expectations with perceptions of performance to lead to confirmation or disconfirmation.

INTRODUCTION

It is well accepted in the business literature that performance and measurement of performance are important issues; see, for example, Hiromoto (1988), Hopwood (1972), Beard & Dess (1981) and Venkatraman & Ramanujam (1986). It has been identified that performance measurement is a key factor in ensuring successful implementation of a company's strategic plan (Berliner and Brimson 1988). Schendel and Hofer (1979) defined performance as being the time test of any strategy.

Chapter 1 of this dissertation identified that the operations strategy literature highlighted the strategic importance of performance, notably external performance (Wheelwright and Hayes, 1985). Also there are dimensions of external performance which are significant in the formulation of operations strategy (see Skinner 1969, Wheelwright 1978, Miller 1983, Hayes and Wheelwright 1984, Hill 1985, 1989, Slack 1991).

The literature on performance and performance measurement is broad and covers many traditional academic subject areas beyond that of operations management. Irrespective of business discipline, many authors have recently identified problems in performance measurement in business.

A persuasive literature has evolved which highlights the inadequacies of many existing performance measurement and

control systems (see, for example, Johnson & Kaplan 1987 and Chandler 1977). Hayes et al (1988) termed this **"Cost accounting's increasing reality variance"** as many of the existing business performance measures are in the domain of cost accounting.

As many of these performance measurement systems were designed for an earlier business era when price competition dominated and they were motivated largely by external reporting requirements, it should not be that surprising to business researchers that they are financially and cost oriented (Hofer, 1983). There are problems associated with profit based measures which are well documented (Emmanual et al 1990). They can be summarised as having two main effects.

Firstly, profit based measures may motivate managers of business functions to act opportunistically on behalf of their own functional area at the expense of the organisation as a whole (Hopwood,1972 and Drury, 1993).

Secondly, profit based measures typically focus on short term performance which may not be in the best long term interests of the business (Johnson & Kaplan 1987 and Hopwood 1972)

The operations strategy literature indicates that a more long term, strategic perspective is required (Hayes & Wheelwright 1984 and 1988, and Hill 1989). Current

measures of performance appear to be inadequate, inappropriate or unavailable to tackle this shift in business focus (Kaplan 1984).

In various business literatures there is some agreement that a balanced score card of a wider range of performance measures, both financial and non-financial, internal and external, could overcome these problems (see for example Parker (1979) and Venkatraman & Ramanujam (1986)). However, there is no agreement as to what these measures should be (Kaplan 1984).

Outside the operations management area, there has been increasing interest recently in the measurement of operational performance. Venkatraman and Ramanujam (1986) proposed that emphasis on operational performance would represent a broader conceptualisation of business performance and would logically include consideration of factors such as product quality, manufacturing value added and technological efficiency. Also that the justification for considering operational performance factors such as these was that they may **lead** to improved financial performance.

This chapter therefore will consider operational performance measurement, focussing in particular on external performance. As operations management look outwards to their customers in their external performance measurement, purchasing looks outwards to its suppliers

to measure supplier performance. In a supply chain, these two functions would be side by side in a dyadic relationship and would therefore be measuring the same performance. Therefore, in addition to examining the operations management literature, the purchasing literature on supplier performance measurement will also be examined. In both these literatures, available models for performance measurement will be examined.

More recently it has been identified in the partnership literature that longer term relationships may need to measure a broader range of factors, some of them softer and less tangible in nature. These factors, measurement approaches and models will be examined.

Softer still is the service quality approach to external performance measurement. Service quality authors consider less tangible, service oriented dimensions of performance and also the importance of expectations and perceptions of performance. These are discussed as their link with customer satisfaction is important here.

Therefore the structure of this chapter is from hard to soft external performance measurement, starting at the hard end of the spectrum with operational external performance measurement.

OPERATIONAL EXTERNAL PERFORMANCE MEASUREMENT

As was shown in chapter 1, historically Operations Management has focussed attention on internal, process oriented issues. It has therefore tended to use internally oriented measures, such as machine utilisation, labour productivity and inventory turnover. However, an operation may be internally efficient, with high utilisation of machinery, high levels of productivity of labour and with fast moving inventory, but customers do not value these aspects of performance. It is possible that an internally efficient operation may, in fact, be **ineffective** in its satisfaction of customers along dimensions which **they** value.

Recently, Slack (1991) has identified the importance of distinguishing between internal and external performance and the linkages between them, stating:

> **"Any manufacturing operation is made up of a collection of smaller operations, where each department, unit or cell is an operation in its own right...internal performance of each contributes to the external performance of the total operation - the performance which the customer sees".**

He provided a model highlighting the linkages between internal and external operational performance, shown below in figure 6.1.

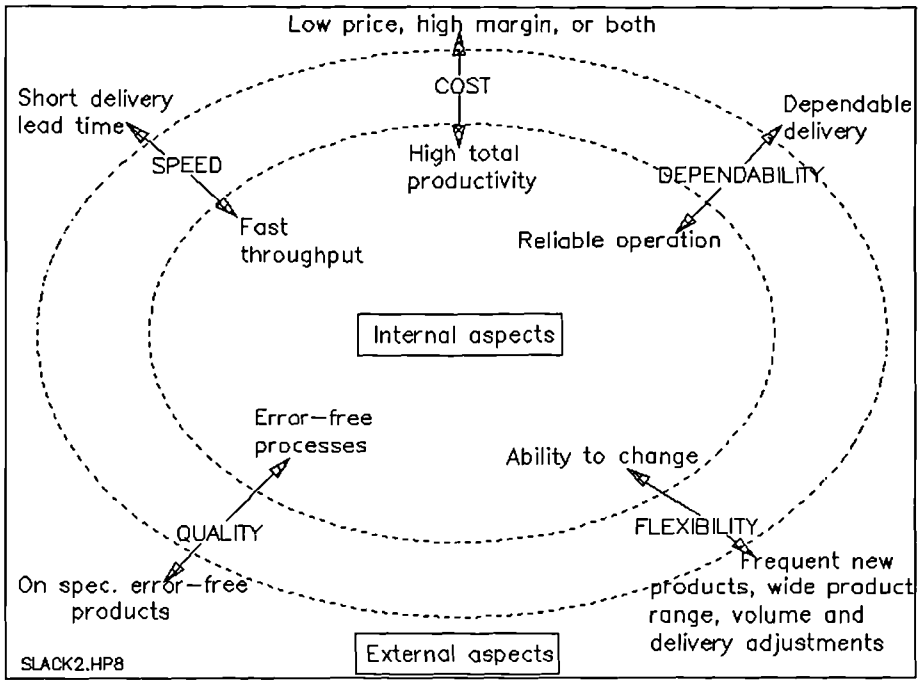


Figure 6.1: Linkages between internal and external operational performance Source Slack (1991)

As Operations Management becomes more externally oriented and more customer oriented, it is a logical conclusion that performance of operations should be judged in terms of dimensions which customers value.

A Customer Perspective

Increasingly operations management authors of the late 1980s and 1990s are using a different vocabulary which includes terms such as **"customers"**, **"customer needs"** and **"customer wants"**. Operations management authors are now providing work dedicated to customer service (see, for example, Armistead & Clark, 1992).

Johnston et al (1993) stated that operations managers have 2 basic objectives:

(i) To meet customer needs
(ii) To make the best use of resources

Schonberger and Knod (1988) sub-titled the 3rd edition their Operations Management text book **"Serving the Customer"**. They identified that the editions of their text had followed the trend in Operations Management from being largely function, technique and model oriented in the late 1970s and early 1980s to having **"service to the customer as the guiding principle on which to judge all actions and all decisions"**. Judging actions and decisions requires measures of performance, therefore if service to the customer is required, service to the customer should be measured.

So, if customers needs are important in determining how we evaluate performance, on what dimensions should performance be measured?

Customer Oriented Dimensions of External Operational Performance

Chapter 1 traced the development of operations management and operations strategy. During that brief review of the chronological development some key contributions to the subject of manufacturing strategy and dimensions of

performance were highlighted. These will be revisited here.

Skinner (1969) highlighted the inability of operations to be good at everything - demands for productivity, time, quality and customer service could not all be satisfied. They forced sacrifice and compromise and were therefore **"trade-offs"**. Clearly some of these dimensions - time, quality and customer service - are externally oriented in that customers may place a value on them. Productivity is not valued by customers, unless, as Slack's (1991) model above in figure 6.1 shows, it is translated and passed on in the form of lower price.

Hayes & Wheelwright (1984), in their introductory discussion on the concept of manufacturing strategy, identified that **"preferences"** or choices can be made within a manufacturing strategy in the area of **"competitive priorities"** which they defined as:

- Price (and therefore cost)
- Quality
- Dependability (products work reliably, they are delivered on time - the strategy emphasises "peace of mind"
- Flexibility (Product flexibility and volume flexibility)

Therefore, Hayes & Wheelwright provided a set of performance dimensions against which a manufacturing operation could be measured, as well as one which would help in the formation of a strategy.

Slack (1991) added speed to Hayes & Wheelwright's list of competitive priorities, with his list of quality, dependability, speed, flexibility and cost / productivity.

By contrast, Hill (1989) listed his order-winning / qualifying criteria as:

- price
- product quality and reliability
- delivery speed
- delivery reliability
- responsiveness to demand increases
- technical liaison and support
- meeting a launch date
- being an existing supplier
- product and colour range

Hill focussed on aspects that a customer values whereas Hayes & Wheelwright and Slack have moved one step away from the customer by including flexibility. Customers do not value flexibility, they value what an operation's flexibility provides which, as Slack identified in his model above in figure 6.1, may include frequent new

products, wide product range and volume and delivery adjustments.

Therefore, whilst it appears that operations management and operations strategy authors agree that a more customer oriented set of dimensions are required, it appears that the operations strategists have not yet reached common agreement on (i) whether these dimensions should be entirely from the customer's viewpoint and (ii) what the dimensions of performance should be. Hill's contribution is substantial in that it provides a wide range of performance dimensions, all of which are customer oriented. Hayes & Wheelwright's and Slack's lists appear less well focused, being neither internal nor external.

Interestingly, once operations management authors had decided in the late 1960s and early 1970s to externalise their perspective, if they had looked to the academic subject of the connected, externally oriented area of Purchasing, they would have found dimensions of supplier performance to guide them i.e. dimensions which buyers used to judge the output performance of the link behind them in the supply chain. The following section considers these.

SUPPLIER PERFORMANCE MEASUREMENT

As far back as 1963, industrial purchasing authors have written about performance dimensions to evaluate suppliers. The National Association of Purchasing Management (NAPM) in the USA published the results of a research study by Smith et al (1963), identifying the value of judging suppliers' performance in terms of:

- Quality
- Delivery
- Price

Later work on vendor rating added the factor of **"service"** (see for example Stevens 1978 and Wieters 1976).

Post purchase performance evaluation of suppliers along these dimensions is justified by Lee and Dobler (1977) as providing the buyer with:

> **"objective information to use in subsequent negotiations and in making future sourcing decisions"**

Smith et al (1963) categorised different approaches to measuring supplier performance into:

(i) Categorical plans

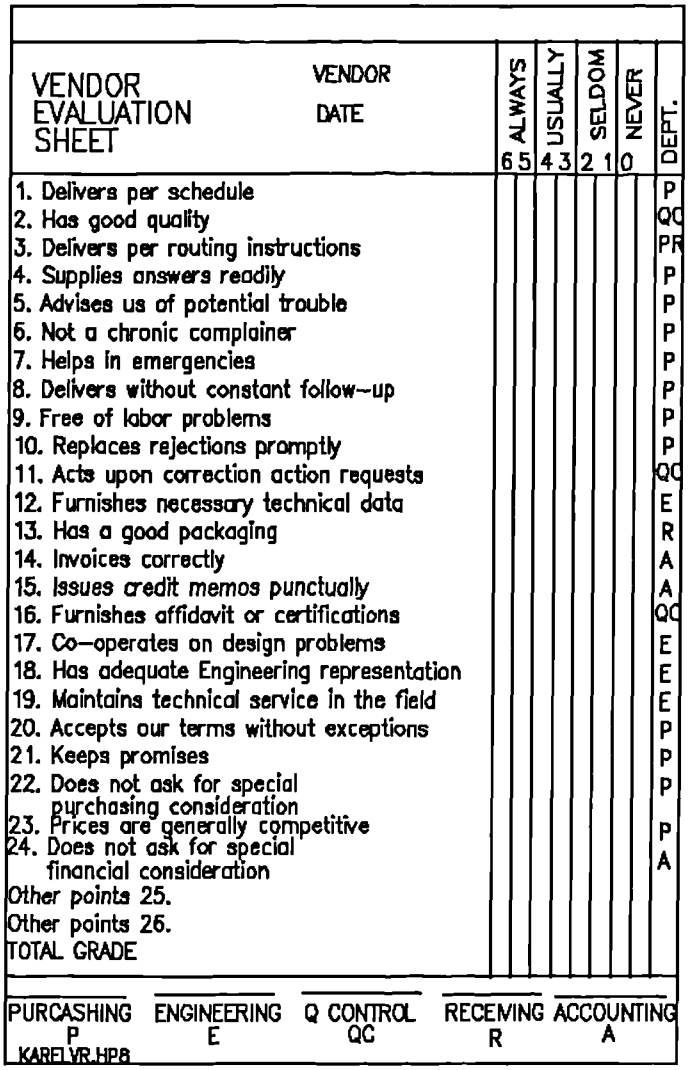
(ii) Weighted Points plans

(iii) Cost Ratio plans

each of which are relatively hard approaches to measuring supplier performance against quality, delivery, price and service dimensions. This categorisation has been subsequently supported by Wieters (1976), Lee & Dobler (1977), Stevens (1978) and Jones (Harland) et al (1987, 1988). Each of these approaches will be briefly described in the following sections.

Categorical Plans

Categorical plans are subjective assignments of ratings to suppliers made by a buying company's personnel on a regular basis (Jones (Harland) et al 1987). Typically they utilise a simple scoring system such as a "three prong" classification of "preferred", "neutral" or "unsatisfactory" or a point scale of 3 or 5 points (Ellis, 1971). The scores are allocated to broad dimensions such as "quality" or "delivery" or to specific statements made about the supplier's performance against a dimension. Karel (1979) provided a score sheet which identified different functional departments' responsibilities for assigning scores for suppliers' performance against specific statements. This is shown below in figure 6.2



VENDOR EVALUATION SHEET

VENDOR

DATE

	ALWAYS 6 5	USUALLY 4 3	SELDOM 2 1	NEVER 0	DEPT.
1. Delivers per schedule					P
2. Has good quality					QC
3. Delivers per routing instructions					PR
4. Supplies answers readily					P
5. Advises us of potential trouble					P
6. Not a chronic complainer					P
7. Helps in emergencies					P
8. Delivers without constant follow-up					P
9. Free of labor problems					P
10. Replaces rejections promptly					P
11. Acts upon correction action requests					QC
12. Furnishes necessary technical data					E
13. Has a good packaging					R
14. Invoices correctly					A
15. Issues credit memos punctually					A
16. Furnishes affidavit or certifications					QC
17. Co-operates on design problems					E
18. Has adequate Engineering representation					E
19. Maintains technical service in the field					E
20. Accepts our terms without exceptions					P
21. Keeps promises					P
22. Does not ask for special purchasing consideration					P
23. Prices are generally competitive					P
24. Does not ask for special financial consideration					A
Other points 25.					
Other points 26.					
TOTAL GRADE					

PURCHASING P | ENGINEERING E | Q CONTROL QC | RECEIVING R | ACCOUNTING A

KAREL\VR.HP8

Figure 6.2: **Categorical Vendor Rating Plan:** Source Karel (1979)

Categorical plans consider a limited range of rational hard dimensions which are assumed by the scoring system to be of equal importance. Because they involve using general questions about performance, they may well illicit a longer term view of buyers about the relationship as a whole rather than about short term transactions but this depends on the regularity of using them.

Weighted Points Plans

Different companies will prioritise dimensions of performance differently, depending on their products and services and how they compete in the market; Dempsey (1978) and Lehmann and O'Shaughnessy (1974) showed that rankings of attributes changed across different product types and buy classes of straight re-buy, modified re-buy or new purchase.

A weighted points plan combines different performance dimensions into an overall score by using weightings to represent the relative importance placed on each performance factor. It provides a structured approach for evaluating supplier performance (Nydick and Hill 1992).

A range of models have been provided to determine the scores for each dimension prior to weighting and aggregating the dimensional scores. For example, delivery models have been provided by Baily (1979), Roberts (1978) and Cooper (1977) which, in different ways, assign scores according to supplier conformance to delivery date. Stevens (1978), Thomas (1972) and Lamberson et al (1976) provided methods to score quality performance of suppliers which scored the items or shipments accepted and rejected and the severity of the cause of rejection.

It has been identified in the literature price and service ratings are more difficult to score (Jones (Harland) et al 1987). Where parts are single sourced

there may be no other supplier to compare prices with. Approaches used in practice have included comparison of current price with tender history, standard cost or estimated price. Jones (Harland) et al (1987) observed that of the four vendor rating factors, service is the most difficult to measure because of the intangible and indefinable nature of service. Also, the dimensions of service which apply to one relationship may not apply to another.

Having assigned scores for each factor the factor scores are weighted according to the relative importance of each dimension, then the weighted factor scores are combined to give a performance rating for each supplier.

Because of the hard nature of the variables (except service) in weighted points plans, this lent them to computerisation quite readily (Hall, 1971, and Tunder & Widing, 1965). Modules were added to Materials Requirements Planning Systems such as IBM's MAAPICS suite to enable automatic scoring and production of vendor management information on relative scores. However, this resulted in the measurement being focused on transactions alone.

Cost Ratio Plans

Smith et al (1963) described cost ratio plans as more sophisticated than categorical or weighted points plans. Cost ratio plans attempt to identify the "true cost of

purchased materials" by estimating the full cost to the business of a late delivery or a failed component, as examples. Whilst the principle of cost ratio plans was initially warmly received, there is little evidence of application and further development of these plans because of their complexity (Kudrna, 1972).

Therefore, it can be seen that the vendor performance rating models provided by the early purchasing literature have focussed on post purchase, primarily hard performance variables. The more recent literature on partnerships has provided models for measuring softer aspects of performance of suppliers, considering dimensions of capability in addition to performance. These will be discussed in the following section.

MEASURING PERFORMANCE IN PARTNERSHIPS

More recent work has identified that a broader set of performance dimensions should be considered to judge long term relationships or partnerships. Ellram (1990) argues that existing supplier selection models tend to concentrate on satisfaction of current needs rather than a supplier's potential and future direction, and lists four additional factors for consideration in forming longer term relationships.

1) Financial issues; economic performance and financial stability

2) Organisational culture and strategy; trust, management attitude, strategic fit etc
3) Technology; current and future manufacturing capability, design capability and speed in development
4) Other factors; safety record, business references, supplier's customer base

It can be seen that this list includes softer dimensions such as trust and management attitude. These broader issues were also considered in work at Glasgow Business School. Macbeth et al (1989a, 1989b, 1990a, 1990b) identified nine dimensions on which to evaluate a relationship with a supplier, dividing them into three categories shown below in table 6.1:

Requirements	Capability	Performance
Physical	Strategy	Quality
Financial	People	Price
Service	Process	Delivery response

Table 6.1: Dimensions for relationship evaluation

This work developed a **"Positionning Tool"** which enabled measurement of relationships with suppliers on these nine dimensions. The positionning tool provided a graphical

view of a relationship's position, the combined performance across all the dimensions being judged visually. For example on the diagram shown below in figure 6.3, Ferguson et al (1989) highlighted that this indicated a **"deficiency in the People factor within the Capability dimension"**

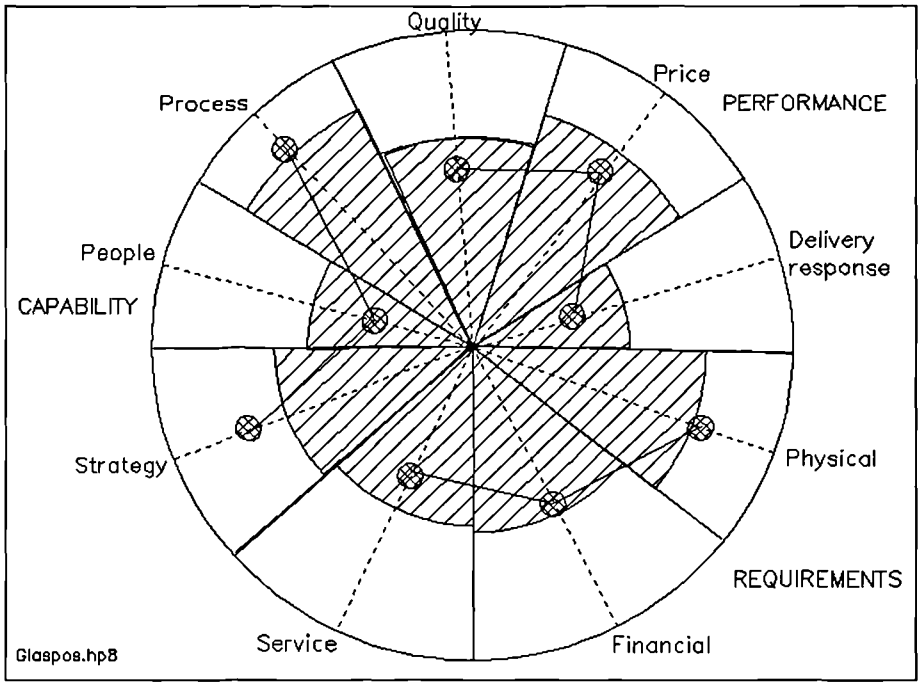


Figure 6.3: Partnership performance positioning tool (Source Ferguson et al 1989)

Cousins (1992), identified the following ten attributes as being important in a partnership:

- price
- delivery
- quality
- innovation
- level of technology
- culture (defined as **"ability to adapt to change"**)

- commerciality (long term viability of both partners)
- productive flexibility
- ease of communication
- current reputation

The work of Cousins (1992) and Brown and Cousins (1992) provided a **"Vendor Management Model"** which Lamming (1993) termed:

> **"a supplier selection and development approach employing multi-criteria decision-making methodologies"**

The above ten attributes were categorised by Brown & Cousins into traditional, long term and mutual co-operation then attributed high and low values of significance, as shown below in figure 6.4:

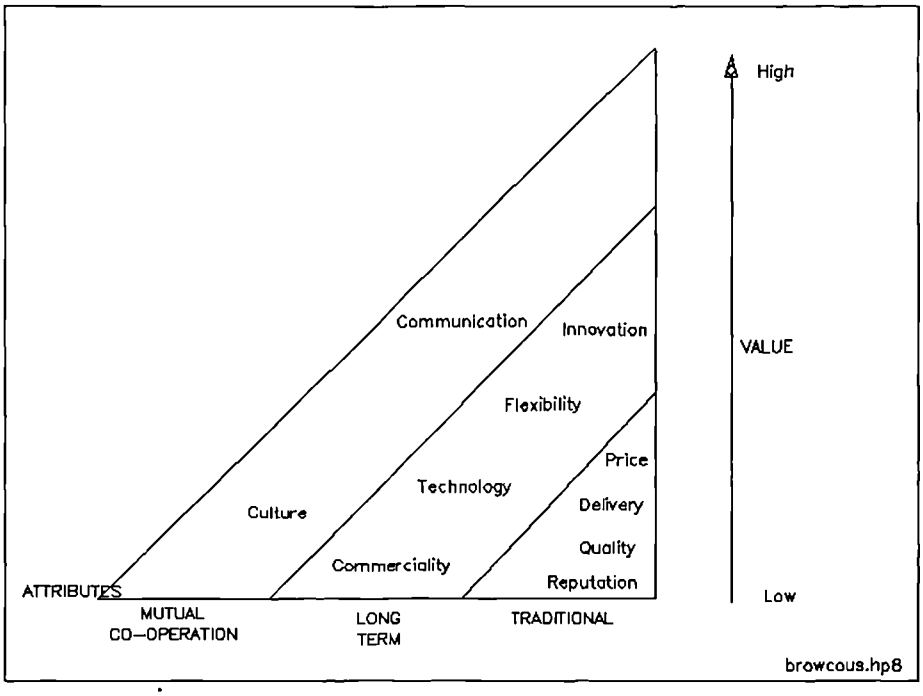


Figure 6.4: **Vendor Management Attributes** Source Brown and Cousins (1992)

They identified that each relationship should be judged separately and that these attributes will have different relative importance to each relationship. i.e. a common, standard level of performance against each attribute is not appropriate; rather a tailored approach to setting performance levels for each relationship is required.

However, these lists of dimensions for measuring performance of partnerships include not only performance dimensions but also attributes of capability. The purchasing literature had, some time previously, clearly differentiated between pre-purchase evaluation of capability (supplier appraisal) and post-purchase evaluation of performance (vendor rating). (See, for example, Lamberson et al 1976 and Sibley 1978). This distinction is not explicit in the partnership performance work.

Before considering the softer approaches to supplier performance measurement, some conclusions will be drawn about the hard approaches.

Conclusions of the Hard Approaches to Performance Measurement

- Traditionally the approaches to measuring performance of suppliers have been short term, transaction oriented approaches based on a limited number of hard variables, notably quality, delivery and price.

- More recently, with the increasing interest in longer term "partnerships" there has been recognition of the importance of measuring relationships along other dimensions. However, there is no common agreement on what these dimensions should be and how measures against them can be made.

- Performance measurement in partnerships has included dimensions to measure capability as well as to measure performance, without explicitiyl differentiating between them.

The next section considers softer approaches to measuring performance from the service quality and service management area.

SOFTER APPROACHES TO PERFORMANCE MEASUREMENT

Zeithaml et al (1990) stated that the **only** criteria of importance in evaluating service quality are those defined by the customer. There is a well developed, albeit relatively recent, body of literature in the service management area which addresses customer oriented, softer performance criteria which will now be considered.

The service quality literature offers an extensive list of service quality characteristics which are effectively

performance dimensions of the broad area of service quality. For example, Parasuraman et al (1985) provided the list shown in the table below:

Dimension	Definition
Reliability	Consistency of performance and dependability
Responsiveness	The willingness or readiness of employees to provide service
Competence	Possession of the required skills and knowledge to perform the service
Access	Approachability and ease of contact
Courtesy	Politeness, respect, consideration and friendliness of contact personnel
Communication	Keeping customers informed in a language they can understand and listen to
Credibility	Trustworthiness, believability, honesty, having the customer's best interests at heart
Security	Freedom from danger, risk or doubt
Understanding / knowing the customer	Making the effort to understand the customer's needs
Tangibles	Physical evidence of service

Table 6.2: **Service quality characteristics** Source Parasuraman et al (1985)

These were later reduced in 1988 by combining some of the factors to five dimensions shown below in table 6.3.

Dimension	Definition
Tangibles	The appearance of physical facilities, equipment, personnel and communication material
Reliability	The ability to perform the promised service dependably and accurately
Responsiveness	The willingness to help customers and to provide a prompt service
Assurance (merging competence, courtesy, credibility and security)	The knowledge and courtesy of employees and their ability to convey trust and confidence
Empathy (merging access, communication and understanding the customer)	The provision of caring, individualised attention to customers

Table 6.3: **Five Dimensions of Service Quality** Source - derived from Parasuraman et al (1988)

Parasuraman et al's dimensions of service quality have received varying degrees of support from other researchers. Haynes & DuVall (1992) expressed favour with their categorisation. However, Cronin and Taylor (1992) attempted to apply the five dimensions to studying service quality in banks, pest control, dry cleaning and fast food and found:

> **"our results suggest that the 5 component structure proposed by Parasuraman, Zeithaml and Berry (1988) for their SERVQUAL scale is not confirmed in any of the research samples"**

Finn and Lamb (1991) attempted to apply Parasuraman et al's dimensions to retailing and found difficulties in applying the concept because they found the five

dimensions insufficient to study service quality in a retail setting.

Fitzgerald et al (1991) found it valuable to expand Parasuram et al's list rather than contract it; they proposed a set of 12 service quality characteristics, shown in table 6.4 below.

Johnston and Silvestro's (1990) list contained a further five factors of:

- attentiveness
- care
- commitment
- functionality
- integrity

The service quality literature appears divided, therefore, in its approach to dimensions of performance with Parasuraman et al favouring a broader band categorisation by contracting their list and Fitzgerald et al and Johnston & Silvestro expanding theirs to more precise categorisations. The topic of service quality measurement is relatively new and appears to be still evolving.

Dimension	Definition
Access	Convenience of unit location, ease of finding way around service environment, clarity of route
Aesthetics	Environment, staff, goods and facilities; includes level of decor, image, dress of staff, taste of food
Availability	service / product availability, staff availability / visibility, product / service range and variety
Cleanliness / tidiness	relates to environment, staff, goods and facilities
Comfort	including seating comfort, atmosphere, ambience, crowdedness
Communication	communication between staff and customer, intelligibility and clarity of information
Competence	staff skill, expertise, knowledge, throughness
Courtesy	Politeness, respect, propriety of staff towards customer
Friendliness	Helpfulness of staff, attentiveness to customer
Reliability	Dependability of staff, service process, facilities. Includes delivery reliability, punctuality, ability to keep to agreed deadlines
Responsiveness	Delivery speed, response times
Security	Personal safety, confidentiality

Table 6.4: **Service Quality Characteristics** Source Fitzgerald et al (1991)

A more established concept relating to performance measurement is the consideration of behavioural aspects of a relationship of **expectations, perceptions** and **satisfaction / dissatisfaction.** This is core to service

management and to consumer behaviour. Each of these will be briefly considered.

Expectations of performance

There has been a growing interest in the literature, particularly since the mid-1980s, on understanding the nature of expectations of customers. Parasuraman, Zeithaml and Berry (1985) stated that service quality **"is a measure of how well the service level matches customer expectations"**. This was supported elsewhere in the literature by Gronroos (1984), Berry et al (1985) and Johnston (1987) who all identified that customers' perceptions of quality are formed as a result of their evaluation of the perceived service against expected service.

Three key points can be made about expectations. Firstly, that different customers may have different expectations (Voss et al 1985). Secondly, that any one customer's expectations may change over time (Cadotte et al 1987, Miller 1986, Swan and Trawick 1980 and Westbrook et al 1983). Thirdly, that expectations may be of different types (Boulding et al (1993))

Each of these key issues associated with expectations will now be briefly discussed.

(i) Different customers have different expectations

Voss et al (1985) highlighted that the requirements for services from every customer may be different as different customers may well have different expectations. Sheth (1973) argued that expectations and satisfaction will substantially differ amongst purchasing agents, engineers and users as they have different objectives and will consider different criteria to be appropriate. They will also receive different sets of information.

(ii) Expectations change over time

Cadotte et al (1987) acknowledged that formation of initial expectations is a well accepted stage of the pre-purchase process; they also argued that there is not necessarily a relationship between initial expectations, perceived performance and consumer satisfaction. **"Success"** is more likely to be determined by how well a consumer perceives that performance meets the present needs, wants or desires.

Miller (1986) and Swan and Trawick (1980) questionned whether the same expectations are standard for post-purchase performance evaluation as were present in pre-purchase selection i.e. the experience of the customer will increase during and after the transaction / encounter. Therefore if a system deals with one-off or infrequent purchases by uneducated buyers, there is likely to be a change in the buyer's expectations over time.

(iii) Different types of expectations

Not only do individuals customer's expectations change over time, but it would appear from the literature that, when asking questions on expectations, clarification is required on what **type** of expectation the customer is chracterising in their response.

Boulding et al (1993) classified expectations as:

- **will expectations** i.e. expectations that customers form about what **will** happen in their next service encounter with an organisation
- **should expectations** i.e. what the customer thinks **should** happen.
- **ideal expectations** i.e. enduring wants and needs that are relatively stable over time

Cadotte et al (1987) proposed that buyers rely on standards which reflect the performance a supplier **should** provide, rather than an ideal; the buyer's performance requirements are constrained by what the buyer believes is possible and is of importance.

However, this recent work on different types of expectations should be viewed with caution. It appears difficult to operationalise and involves assumptions of cognitive processing which have yet to be validated.

Perceptions of Performance

As beauty is said to be in the eye of the beholder, so too is performance. In the service quality literature it is stressed that customers' perception of quality is critical (see for example Sasser et al 1978, Parasuraman 1985, Gummesson 1987, Berry & Parasuraman 1991 and Cronin and Taylor 1992).

Customers' perceptions may be affected by the following (Haywood-Farmer and Nollet 1991):

(i) the customer may not be qualified or able to judge certain aspects of the service and

(ii) the customer's perception can be influenced by what it thinks the provider is doing .

i.e. a customer's view of performance can be influenced by actions taken by the supplier which, in reality, do not necessarily lead to better performance.

The ideas of perception have been extended to longer term situations; in the relationship literature, Carlisle and Parker (1989) explained that **"it is perceptions which really determine success or failure in the development of the relationship".**

There is general agreement in the literature that, despite any apparent inaccuracy in their views,

customers' perceptions are the only effective measures of service quality. Zeithaml (1988) distinguishes between "perceived quality" and "objective quality" by suggesting that the latter may not actually exist:

> **"all quality is perceived by someone, be it consumers or managers or researchers"**

The literature has linked performance dimensions with expectations and perceptions of performance. The relationships of Parasuraman's dimensions with expectations and perceptions of service quality were shown in a model published by Zeithaml et al (1990)

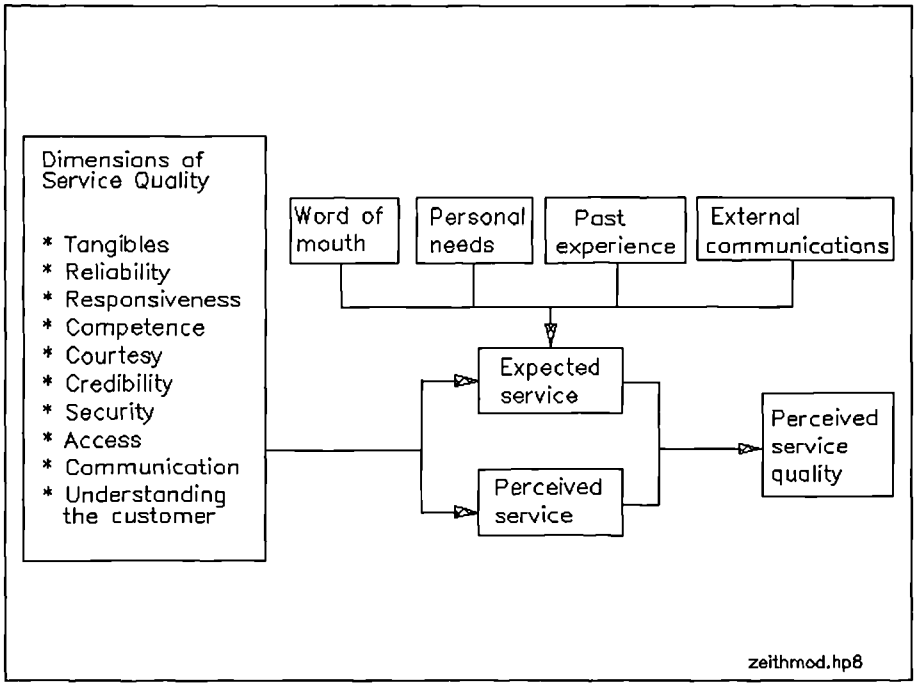


Figure 6.5: **Service quality, expectations and perceptions of performance** Source Zeithaml et al (1990)

Having established the link between expectations and perceptions of performance, these will now be linked to satisfaction or dissatisfaction of customers.

Satisfaction / dissatisfaction with Performance

Customer satisfaction or dissatisfaction has been identified as being critical to the retention of customers (see for example Engel et al 1993) and to the long term success of the business (Wilkie, 1986). As a topic it appears to have received most interest in the service management literature and in the consumer behaviour literature.

The service management literature links expectations and perceived performance with customer satisfaction. Berry and Parasuraman (1991), Brogowicz et al (1990), Gronroos (1990) and Haywood-Farmer & Nollet (1991) all claim that customer satisfaction arises as a result of the customer comparing their expectations to their perception of performance. Davidow and Uttal (1989) stated:

> **"Satisfaction, or the lack of it, is the difference between how a customer expects to be treated and how he or she perceives being treated"**

Berry and Parasuraman (1991) demonstrated this connection with, what they termed, a **"continuum of perceived service quality"** as shown below in figure 6.6:

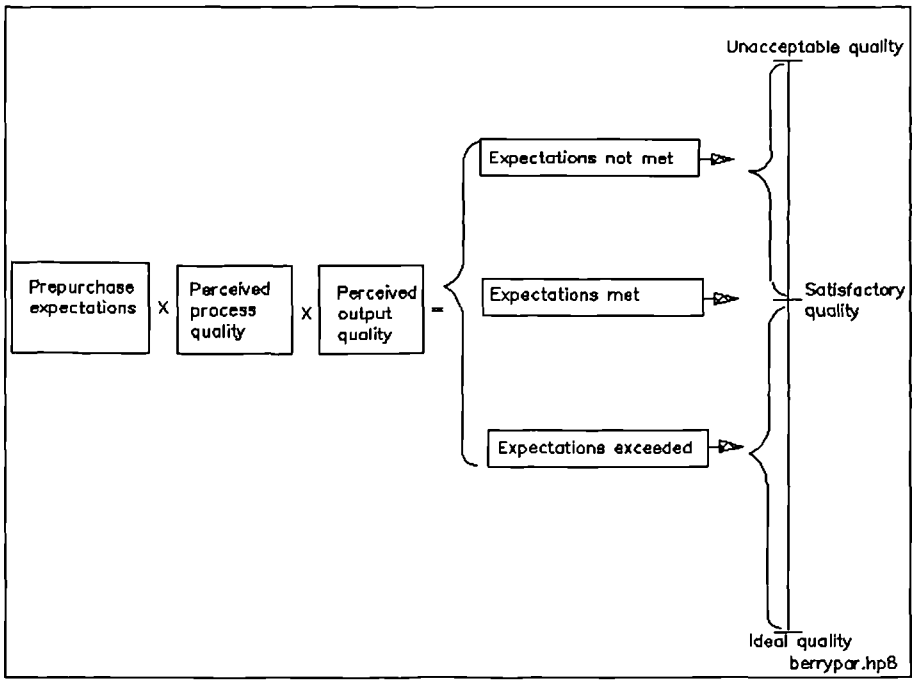


Figure 6.6: **Continuum of perceived service quality**
Source: Berry & Parasuraman's (1991)

The same principle was presented in a different way by Johnston & Lyth in Brown et al (1991) (figure 6.7. below) who represented a diagonal as the coincidence of service expectation with service provision; straying either side of the diagonal represented either (i) under-achieving or (ii) over-achieving.

There appears to be common agreement that straying from the diagonal because of under-achieving, compared to expectations, is a bad thing. However, there is not common agreement that straying from the diagonal because of over-achieving is wrong. Recently the phrase of **"delighting the customer"** has been a subject of interest. Rose (1991) proposed, rather than satisfy, a supplier should try to delight customers. Kempner (1990)

identified several companies who deliberately tried to go beyond satisfaction; these included Singapore Airlines, Caterpillar and American Express.

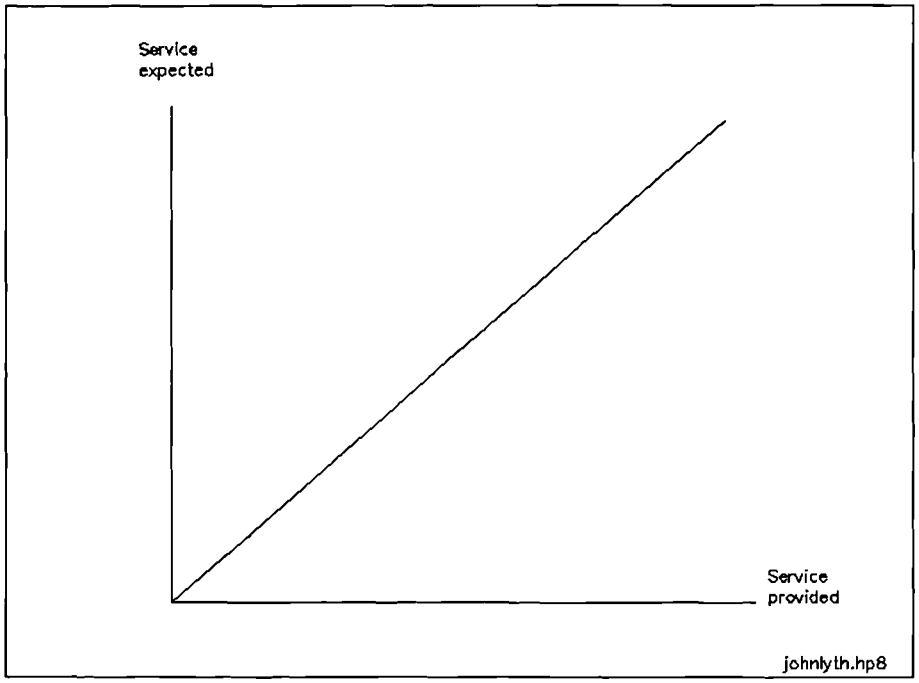


Figure 6.7: **Model of satisfactory and unsatisfactory outcomes** Source Johnston & Lyth in Brown et al (1991)

Therefore, the service management literature explicitly connects satisfaction of customers back to their perceptions of performance which, they judge, customers are comparing to their expectations along certain dimensions.

The service management literature findings of Berry and Parasuraman (1991), Brogowicz et al (1990), Gronroos (1990) and Haywood-Farmer & Nollet (1991) echo the

earlier consumer behaviour literature findings. For example, in the consumer behaviour literature Cardozo (1965) linked satisfaction to expectations by explaining that satisfaction is lower when the product does not come up to expectations than when the product meets expectations. Swan and Combs (1976) also identified that satisfaction arises from the fulfilment of expectations. Cardozo also highlighted that the perceived importance of a product to a customer affects the level of dissatisfaction they experience i.e. the more important the purchase, the greater the dissatisfaction the customer will feel if the purchase does not meet expectations.

From these concepts the theory of **expectancy disconfirmation** was born i.e. customers form expectations; disconfirmation of these expectations occurs through comparison of performance with expectations. Disconfirmation can be positive, if the product exceeds the customer's expectations, or negative if the product fails to meet expectations. The expectations are confirmed if the product exactly meets expectations i.e. disconfirmation or confirmation relates to expectations (see Oliver, 1980 and Churchill & Surprenant, 1982). This has since been linked to customers intentions to repeat purchase (Bearden and Teel, 1983, and Woodruff et al, 1985)

Oliver (1980) did not specifically distinguish between performance and perceptions of performance. Cadotte et al (1987) further developed the theory of disconfirmation by specifically including perceptions of product performance. It was more recently explicitly recognised that the earlier work on disconfirmation had been lacking in its failure to include perception of performance. Spreng and Olshavsky (1992) stated:

> **"Perceived performance has (recently) been included in the disconfirmation of expectations model as the referent against which expectations are compared. However, many past researchers have not included performance as a direct antecedent of satisfaction"**

Bolton and Drew (1991) concluded that for continuously provided services, customer evaluations are based primarily on prior attitudes and current performance with disconfirmation only featuring as a transitory factor when significant changes occurred. Bitner et al (1985) also highlighted the importance of a significant change or **"critical incident"** on customer evaluations of performance in continuous situations; their **"critical incident technique"** involves identifying and analysing these critical incidents.

It appears, therefore, that the consumer behaviour literature on satisfaction / dissatisfaction and the service management literature on service quality are both

sources of knowledge in the area of performance. However, they are not identical; i.e. it does not appear that satisfaction equals service quality as some authors have made a distinction between the two.

Distinguishing between satisfaction and service quality:
Bolton and Drew (1991) define satisfaction as:

> **"a customer's post-purchase evaluation of a product / service offering"**

and propose that customers' satisfaction / dissatisfaction with a service at a point in time depends on his or her current perceptions of:

- performance
- prior expectations about performance
- discrepancy or **disconfirmation** between the two.

Boulding et al (1993) and Bolton and Drew (1991) define service quality in the longer term. They identify that attitudes, which are equated to perceptions of service quality, are the customers' global evaluation of product or service quality and are a function of previous attitudes (which Bitner et al, 1985, would argue are heavily influenced by a critical incident) and satisfaction / dissatisfaction with the current service.

Cronin and Taylor (1992) also differentiated between satisfaction as being short term and service quality long term in their definition of:

> **"perceived service quality is a form of attitude, a long run overall evaluation, whereas satisfaction is a transaction specific measure"**

So which should be considered when performance is to be measured - the short term transaction or the longer term attitude?

Boulding et al (1993) argue that behavioural outcomes such as loyalty and positive word of mouth are a function of overall cumulative perceptions of quality of service rather than short term satisfaction with individual transactions. Models have been proposed to explain any causal linkages between service quality and purchasing behaviour but very little quantitative research has been done to test the models (Boulding et al 1993, and Cronin and Taylor, 1992).

It could be concluded that. whilst the literature acknowledges the effect of service quality on purchasing behaviour, the linkages are not well understood. There is also some debate about the relative roles of cumulative attitudes, short term satisfaction and other variables that may contribute to a customer's perception of value.

Having identified so far that:

(i) A clear view of expectations is required

(ii) An understanding of perception of performance is required

(iii) A longer term perspective of customers views is required if indications of the likelihood of repeat purchase are sought

it is logical to conclude that, if we sought to measure performance in a relationship, the performance measurement system of approach should incorporate these features.

The next section reviews appropriate available models for performance measurement which variously consider different dimensions of performance, customer expectations, perceived performance, identifying those which appear to take a shorter term, transaction oriented view of performance and those which appear to take a longer term, relationship and attitudinal view of performance.

Models for measuring softer aspects of performance

Even within the softer approaches, some are harder than others. For example, Johnston and Lyth (1989) expressed customer satisfaction as being the sum of satisfactions

of various service quality factors weighted according to a customer's feelings i.e. the same approach as the weighted points plan identified earlier, taken from the purchasing literature. Heskett et al (1990) defined value as service quality divided by price and other customer costs of acquiring a service.

The most widely accepted model of measurement of performance from the service management literature is that provided by Parasuraman et al (1985) called SERVQUAL. SERVQUAL is an instrument to measure service quality by use of a questionnaire to find out customer expectations of excellent service and their perceptions of service from a company.

The SERVQUAL tool identifies 22 generic statements or items that describe aspects of customers' expectations and perceptions of service quality across the five dimensions identified earlier in this chapter. Parasuraman et al's (1985) gap model identified gaps which could be measured; having identified where serious gaps occurred, attempts could be made to close them. Their gap model is shown below in figure 6.8.

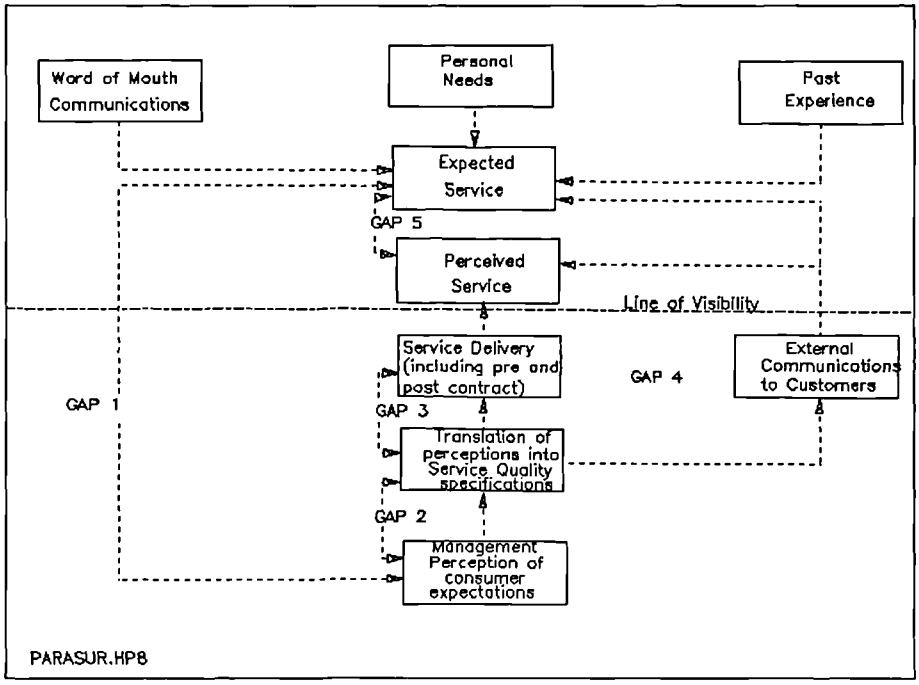


Figure 6.8: **Gap Model for Measuring Performance of Service Quality** Source Parasuraman et al (1988)

As can be seen in the above diagram, the following gaps are identified in the model:

Gap 1: The gap between the management perception of consumer expectations and the consumer's expectations

Gap 2: The gap between the management perception of consumer expectations and the supplying company's translation of consumer expectations into a service quality specification

Gap 3: The gap between the supplying company's specification and their service delivery

Gap 4: The gap between the supplying company's service delivery and what they communicate to their customers e.g. the difference between order promise date and order delivery date

Gap 5: The gap between the customer's expectation of service and their perception of the service they receive

Since Parasuraman et al's model the service management literature has further developed and further complicated this gap model (see for example Gronroos (1990) and Brogowicz et al (1990)) but they have all held core to their models that the gap between customers' perception of performance and their expectations is central to customers' perceptions of service quality.

A simpler gap model provided later by Carlisle and Parker (1989) is shown below in figure 6.9. This gap model explores far less than the Parasuraman et al's model in terms of identifying specific gaps at different stages of the interpretation and translation process, transforming customer requirements to ultimate service delivery and perception of service delivery. However, it does usefully identify that in a relationship there are 2 parties, both of which are taking actions and both of which are forming perceptions of the other. Carlisle and Parker (1989) suggest that such a gap model can be used when setting up a relationship as an initial means of providing an agenda

to be discussed across the table by parties to the proposed relationship.

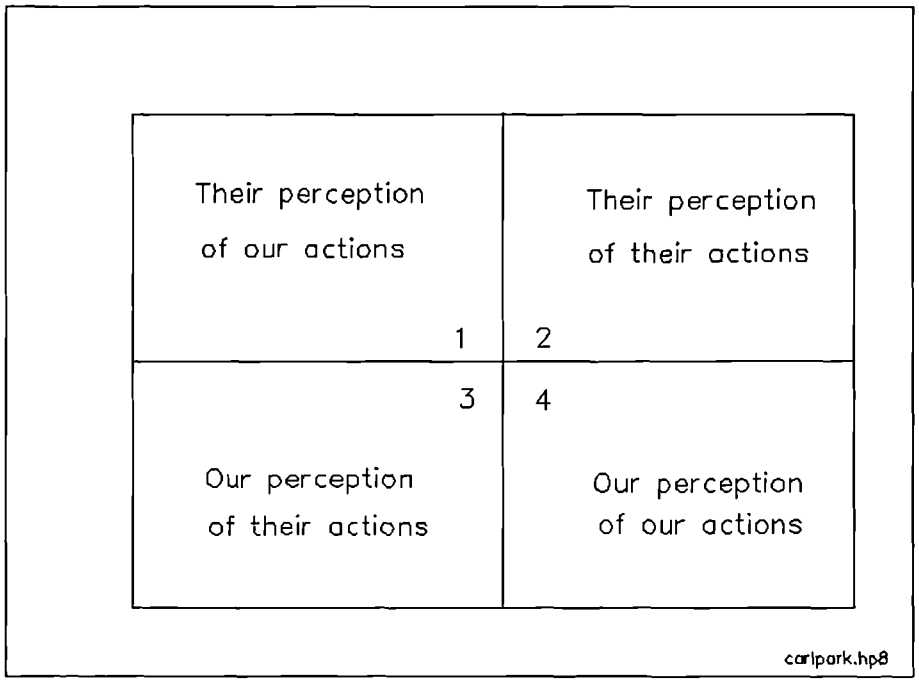


Figure 6.9: **4 way perception assessment** Source Carlisle and Parker's (1989)

It could be argued that the Carlisle and Parker gap model is more appropriate to non-consumer relationships than Parasuraman et al's model as it treats both parties to the relationship as equals. This symmetry echoes the points made by Hakansson & Wootz (1979) that a more symmetrical interaction occurs in industrial relationships than consumer relationships. Therefore, **both** parties perceptions of each other should be considered.

CONCLUSIONS

The following conclusions can be drawn from the literature on measuring external performance:

- Measurement of performance is important within business (Hiromoto 1988, Hopwood 1972, Beard & Dess 1981 and Venkatraman & Ramanujam 1986) and is key to ensuring successful implementation of a company's strategic plan (Berliner & Brimson 1988, and Schendel & Hofer 1979).

- Operational performance is being viewed as a significant factor in organisational performance and should therefore be measured (Venkatraman & Ramanujam 1986 and Parker 1979)

- Currently performance measurement systems are inappropriate or unavailable to incorporate this shift in measurement focus (Johnson & Kaplan 1987, Chandler 1977, Hayes et al 1988, Hofer 1983, Kaplan 1984)

- Choice of and emphasis on dimensions of external performance are significant in the formulation of operations strategy (Skinner 1969, Wheelwright 1978, Miller 1983, Hayes & Wheelwright 1984, Hill 1984, 1989 and Slack 1991).

- Operations management and operations strategy have judged external performance along dimensions including price, quality, dependability and flexibility (Skinner 1969, and Hayes & Wheelwright 1984), plus speed (Slack 1991) plus technical liaison and support, being an existing supplier and product and colour range (Hill 1985 and 1989)

- Purchasing have viewed performance of suppliers along dimensions of price, quality, delivery (Smith et al 1963) plus service, (Stevens, 1978 and Wieters 1976), more recently adding capability oriented dimensions including financial issues, organisational culture and strategy, trust, management attitude, technology, safety record, (Ellram, 1990), people, strategy and process (Macbeth et al 1989a, 1989b, 1990a, 1990b), innovation, commerciality, ease of communication and current reputation (Cousins 1992).

- Service management has provided a longer, customer oriented set of performance dimensions including reliability, responsiveness, competence, access, courtesy, communication, credibility, security, understanding / knowing the customer, tangibles, (Parasuraman et al 1985), plus aesthetics, availability, cleanliness / tidiness, comfort, friendliness, (Fitzgerald et al 1991), plus attentiveness, care, commitment, functionality and

integrity (Johnston & Silvestro 1990). These have received some support but difficulties in applying these have been reported (Cronin & Taylor 1992, Finn & Lamb 1991).

- There is no common agreement on what these dimensions of performance are but it has been identified that they should be specific to the relationship (Birt & Cousins, 1993), to how products and services compete in the market (Dempsey 1978) and to product type and buy class (Lehmann & O'Shaughnessy 1974). Hofer (1983) stated

  "it seems clear that different fields of study will and should use different measures of organisation performance because of the differences in their research questions"

- In addition to consideration of choice of dimension, customers' expectations are an important issue (Parasuraman et al 1985, Gronroos 1984, Berry et al 1985 and Johnston 1987).

- ...as comparison of expectations is made with perceived performance (Sasser et al 1978, Parasuraman 1985, Gummesson 1987, Berry & Parasuraman 1991 and Cronin & Taylor 1992)

- ...to give rise to satisfaction / dissatisfaction in the short term (Johnston & Lyth 1991, Boulton & Drew 1991 and Cronin & Taylor 1992)

- ...or perceived service quality in the long term (Zeithaml et al 1990, Boulton & Drew 1991, Cronin & Taylor 1992 and Boulding et al 1993)

- This gives rise to expectancy disconfirmation (Oliver 1980, Churchill & Suprenant 1982)

- ... which has been linked to customers intentions to repeat purchase (Bearden & Teel 1983, Woodruff et al 1985)

- Available hard models of output performance measurement are provided in the purchasing literature in the form of vendor rating systems (Smith et al 1963, Wieters 1976, Lee & Dobler 1977, Stevens 1978, and Jones (Harland) et al 1987, 1988)

- ... and positionning tools (Ferguson et al 1989, Macbeth 1989a, Cousins 1992 and Brown & Cousins 1992)

- These hard models do not incorporate consideration of expectations, perception and satisfaction / dissatisfaction

- Soft models of performance measurement available include gap models (Parasuraman et al 1988, Gronroos 1990, Brogowicz et al 1990 and Carlisle and Parker 1989) which do include consideration of expectations and/or perceptions.

It appears, therefore, that the service management literature has taken account of perceptions and expectations in its dimensions and models for measuring performance in a way that the general Operations Management and Operations Strategy literatures haven't. This has been attributed to the view that there is a harder, manufacturing orientation to Operations Management whereas the roots of service management are in marketing (Gummesson, 1991).

To conclude the implications for supply chain management, supply chains involve consumer and non-consumer relationships. Some relationships in a supply chain are likely to be more service oriented than others. There appears to be a gap in the literature on performance measurement on a broad range of dimensions, both hard and soft which may be applicable to supply chain management. This is further developed in chapter 9 when the specfic instrument of research for this work in supply chain management is discussed.

CHAPTER 7 - DEVELOPMENT OF HYPOTHESES

SUMMARY

This chapter draws out conclusions from the literature about relationships, chains and the context of the network, the industry and territories.

Gaps in the literature are used to ask research questions and to identify research issues.

It is identified that there is less knowledge on less formal types of relationships than formalised forms such as comakership.

Regarding performance in relationships, there is a desire for operations management to be more service oriented but little knowledge on how to operationalise this. The service quality approach of viewing performance in terms of gaps between expectations and perceptions of performance giving rise to satisfaction is not well established in non-consumer environments. This adds to the difficulty of operationalising a more service oriented approach.

Regarding performance in supply chains, it is claimed in the literature that knowledge of end customer needs throughout the chain improves performance; this has yet to be proven or operationalised.

The literature has identified the importance of position in the supply chain and empirically supported the effect of this on demand distortion. However, there is less empirical work evident on other implications of position in the chain.

The hypotheses formulated in this chapter are centred around (i) operationalising the service orientation of relationships by measuring behavioural aspects of performance, looking for gaps and relationships and (ii) identifying if position in the chain is related to these gaps.

The chapter concludes that this research will contribute to the new holistic approach to supply chain management. Uniquely, it will apply a service oriented approach to understanding performance in supply chains, thereby helping to integrate the disparate operations management and service management literatures. Most importantly, it will add to knowledge on the effect of position in the supply chain by relating this to the amount of misperceptions and dissatisfaction in relationships.

INTRODUCTION

The previous five literature chapters have traced:

Chapter 2: Operations Management becoming externally focused

Chapter 3: Development of ideas on the strategy and structure of inter-organisation relationships

Chapter 4: Development of ideas on the infrastructure of inter-organisation relationships

Chapter 5: Development of the concept of Supply Chain Management

Chapter 6: Development of ideas on performance and performance measurement

The objective of this chapter is to draw out gaps and questions from the literature chapters. From these, issues will be identified which appear to be of research interest. It may not be possible or desirable to research all these issues in this one piece of research. Therefore, a sub-set of these issues will be selected, upon which a cohesive set of research hypotheses will be formulated.

It was identified in chapter 5 that supply chain management has been viewed as relating to the internal supply chain, to a firm's relationships with its immediate suppliers, to a connected chain of organisations, to a network of organisations and to a

form of market organisation in an industry. Differences between approaches in different territories have been observed. It has been clarified that this research is interested in inter-organisation, as opposed to intra-organisation chains, therefore the first of these will not be considered as a possible area for research. Taking a systems approach, that leaves five systems for consideration, all of which could potentially be worthy of research. These are depicted in figure 7.1 below:

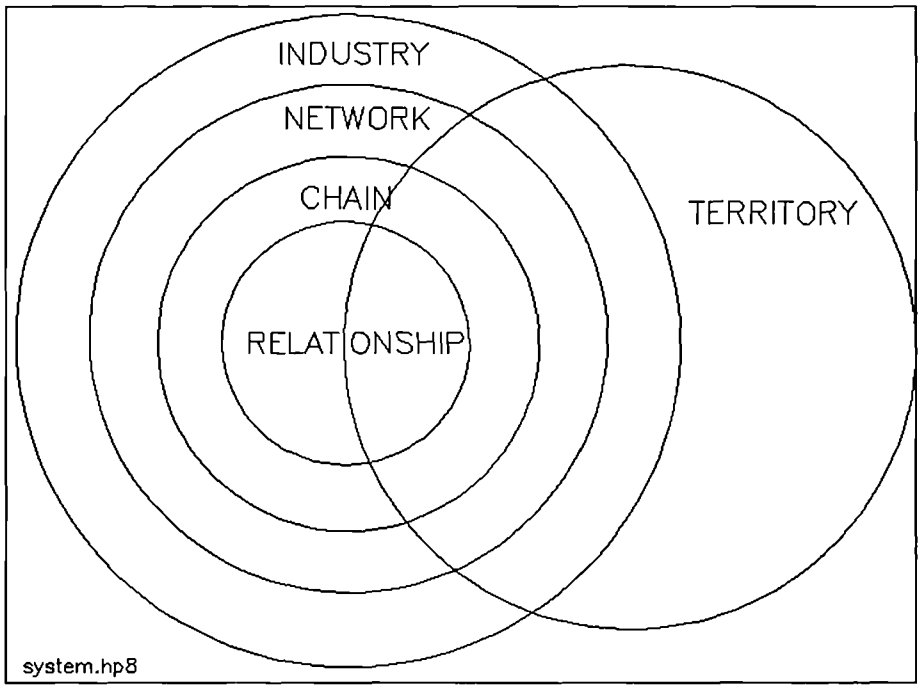


Figure 7.1: **Systems view of supply chains.** Source: Derived from Jones (Harland) et al 1991

The definition for supply chain management derived in chapter 5 emphasised that all these levels are important. The following discussion starts in the centre and works out, identifying for each level potential research issues.

Firstly, gaps and questions about relationships are drawn out.

RELATIONSHIPS

Chapter One traced the development of Operations Management from its origins in the Industrial Revolution in the form of Factory Management. The stages of development it went through were discussed - through scientific management and operational research orientations in Production Management, to a broader, more strategic perspective in Operations Management which integrated service management and production management.

It was identified that Operations Management has historically been focused on the level of the firm. It is only relatively recently that Operations Management has looked outwards upstream to its supply market or downstream through distribution with any seriousness. With the exception of some texts (notably Wild, 1971) it is only recently that chapters on logistics, purchasing and materials management and / or procurement have been included in operations management texts (see Schmenner 1990, Meredith 1992 and Schonberger & Knod 1988).

This externalisation of operations has necessarily increased interest in the types of relationships that are formed with other parties.

Types of relationships

It was identified in Chapter One that it was only in the 1980s that topics such as "vertical integration and sourcing" (Hayes and Wheelwright, 1984) were viewed as a strategic operations management decision making area. This development in the subject clearly signalled the overlaps with other traditional academic subject areas which had not been highlighted before. "Fundamental concerns" identified by Hayes and Wheelwright (1984) included:

" 1. **What boundaries should a firm establish over its activities?**

2. **How should it construct relationships with other firms - suppliers, distributors and customers - "outside" its boundaries?**

3. **Under what circumstances should it change its boundaries or these relationships, and what will be the effect on its competitive position?"**

Points 1 and 3 identified conceptual interest common to strategic management, the theory of the firm and industrial organisation. However, Hayes & Wheelwright's emphasis was more at the level of the firm and its immediate relationships rather than at the level of the market and the organisation of that market.

Common conceptual interest with purchasing and marketing was identified particularly by point 2.

Much of the development of operationally oriented literature on relationships has been in the area of purchasing. The conclusions of the purchasing literature on relationships, highlighted in chapter 4, show a shift in emphasis, particularly from the late 1980s onwards. The purchasing literature has developed from traditionally viewing dealing with suppliers as adversarial, rational, negotiated agreements (see for example Robinson et al 1967 and Lee & Dobler 1977) to more recently considering longer term, co-operative relationships or partnerships (Lamming 1993, Cousins 1991, Lorange & Roos 1992, Contractor & Lorange 1988, Badaracco 1992, Kantner 1989 and Powell 1987) though the discussion of these has not been limited to the purchasing literature.

Longer term relationships were described in chapter 3, as they were shown to have different structural implications to shorter terms relationships. Child's (1987) categorisation of types of relationships was shown to be:

- Integrated hierarchy
- Semi-hierarchy
- Co-contracting
- Co-ordinated contracting
- Co-ordinated revenue links
- Spot networks

It was identified in chapter 4 that the category of spot networks was too broad to be useful, so was broken down into:

- Long term trading commitment
- Medium term trading commitment
- Short term trading commitment

One of the conclusions drawn from chapter 3 was that significant attention had been paid since the 1960s to vertical integration i.e hierarchical organisational forms, through work including Bain (1968), Clark (1961), Bucklin (1966), Harrigan (1983, 1985) and Jacquemin (1987). It was also concluded at the end of this chapter that there was less clarity in the literature regarding intermediate organisational forms between market and hierarchy.

Chapter 4 explored the nature of exchange in these intermediate types of relationship such as comakership and it concluded that, whilst more recent attention had been paid to some intermediate organisational forms,

others had received less attention. Notably, long and medium term trading relations with no formal long term commitment have received less attention than have more formalised relationships such as comakership and licensing. The categorisations of authors such as Child (1987) and Ellram (1990) are evidence of this as they pay little attention to them.

The literature concluded that performance is an increasingly important topic in Operations Management. Chapter 1 identified that Operations Strategy is taking a more external performance oriented view of operations (see Skinner 1969, Wheelwright 1978, 1984b, Miller 1983, Hayes & Wheelwright 1984, Hill 1985, 1989, Wheelwright & Hayes 1985, Womack et al 1990 and Slack 1991).

Womack et al (1990), Dore (1983), Lamming (1993) and Thackray (1986) have provided evidence of performance in more formalised co-operative relationships such as comakerships. However, there is little evidence of performance oriented work in longer term, less formal relationships to enable true comparisons.

Therefore, the following gap in the literature is identified:

GAP 1

There appears to be less evidence of knowledge and research into performance in less formal intermediate types of relationships i.e. long and medium term trading commitments.

This raises many questions as yet unanswered by the literature which could be asked, including the following:

QUESTIONS 1

Given that different things are exchanged in different types of relationship, does this affect the operational behaviour of the partners? Is performance any better in some types of relationship than others e.g. are comakerships more successful than less formal relationships?

These questions lead to the following research issue:

RESEARCH ISSUE 1

Comparative research across the whole spectrum of different types of relationships could yield information on the relationship of relationship type to operational behaviour and performance. This research would be necessarily complex and large scale. A long term longitudinal study may be required to capture data. Albeit an interesting study, it is not considered central to this work on supply chain management.

Performance Dimensions

The operations management and purchasing literatures have taken a hard, rational, negotiated view of performance (see Slack 1991, Hayes & Wheelwright 1984, Hill 1985, 1989, Lamberson et al 1976, Sibley 1978, Stevens 1978, Wieters 1976).

More recently, operations management authors have expressed favour towards moving away from this hard rational approach to include softer, less tangible, service aspects of relationships (see Carlisle & Parker 1989, Ellram 1990, Cousins 1992, Crosby et al 1990). The service aspects were seen as an increasingly important part of the total package provided to customers.

The service management literature was shown to have provided service oriented dimensions against which performance could be assessed (see Parasuraman et al 1985 and 1988, Johnston & Silvestro 1990 and Fitzgerald et al 1991). However, these dimensions had largely been applied to consumer oriented, high contact relationships. Also research had shown difficulty in applying them to the harder, product oriented end of service operations e.g. in retail environments (Finn & Lamb 1991).

There appears to be the following gap in the literature:

GAP 2

There appears to be little knowledge and research to help operationalise the desire of Operations Management to become more service oriented in terms of providing guidance on what these service dimensions are and how they should be measured.

The following questions could be posed.

QUESTIONS 2

Are the performance dimensions provided in the service management literature meaningful for performance measurement of the service part of the package in non-consumer, lower contact relationships? Does the relevance of different dimensions of performance in relationships relate to factors such as contact or tangibility?

This leads to the following research issue:

RESEARCH ISSUE 2

Research on the dimensions of performance in relationships that span the spectrum from hard, product oriented manufacturing environments to softer, service oriented environments could identify the general applicability of different dimensions to different operations environments.

However, whilst interesting and relevant to service management and operations management, this is not peculiar to supply chain management.

This gap between service management and the rest of operations management was more evident when the topic of measuring performance was considered in chapter 6.

Measuring performance

It has been shown that the service management and consumer behaviour literatures highlighted the importance of:

(i) Taking a customer oriented approach to understanding performance (see Zeithaml et al 1990, Parasuraman et al 1985, 1988, Johnston & Silvestro 1990 and Fitzgerald et al 1991)

(ii) Understanding customers' **expectations** (see Parasuraman et al 1985, Gronroos 1984, Berry et al 1985, Johnston 1987, Voss et al 1985, Cadotte et al 1987, Miller 1986, Swan & Trawick 1980, Boulding et al 1993 and Sheth 1973)

(iii) Understanding customers' **perceptions** of performance as opposed to a notional "actual" performance or the suppliers'

perceptions of performance (see Sasser et al 1978, Parasuraman 1985, Gummesson 1987, Berry & Parasuraman 1985, Cronin & Taylor 1992, Haywood-Farmer & Nollet 1991, Carlisle & Parker 1989, Zeithaml 1988, Zeithaml et al 1990)

(iv) Recognising that **satisfaction / dissatisfaction** is critical to business (for example, Wilkie 1986 and Engel et al 1993) and is linked to expectations and perceptions of performance (see Cardozo 1965, Swan & Combs 1976, Berry & Parasuraman 1991, Brogowicz et al 1990, Gronroos 1990, Haywood-Farmer & Nollet 1991, Davidow & Uttal 1989, Johnston & Lyth in Brown et al 1991)

(v) Recognising that disconfirmation of expectations occurs through customers' comparison of performance with expectations (see Oliver 1980, Churchill & Suprenant 1982, Cadotte et al 1987 and Spreng & Olshavsky 1992)

(vi) ... but that for continuously provided services, customer evaluations are based primarily on prior attitudes and current performance, with disconfirmation only

featuring as a transitory factor when significant changes occur (see Bolton & Drew 1991 and Bitner et al 1985).

The importance of expectations had been recognised in industrial relationships by the Industrial Marketing and Purchasing's interaction model discussed in chapter 4 (Hakansson 1982). However, apart from that work, it appears that a behavioural approach to operations, understanding the expectations, perceptions of performance, satisfaction / dissatisfaction link has largely been applied to consumer relationships.

This highlights the following gap:

GAP 3

The literature appears underdeveloped in providing understanding of the general applicability of the expectations, perceptions of performance, satisfaction link to non-consumer relationships

This gives rise to many possible questions, including the following:

QUESTIONS 3

Is satisfaction in non-consumer service relationships linked to the gap between their expectations and their perceptions of performance? If it is, do supplying companies understand

customers' expectations? Do both parties in the relationship share the same view of performance? Does the supplier's view of any performance gap match the customer's view. Are any gaps in these perceptions of both parties related to different performance dimensions - for example, do the gaps differ between delivery and quality dimensions?

This gives rise to the following research issue:

RESEARCH ISSUE 3

Research in operations environments other than the provision of services to consumers could be performed to identify if the expectations / perceptions of performance / satisfaction model is generally applicable. Also the occurrence of gaps in perceptions between parties to the relationship could be explored to identify if they relate to variables such as performance dimension being studied.

As this is appears key to operations management and to supply chain management, it certainly appears worthy of research. It would required research which gained an understanding of expectations, perceptions of performance and satisfaction within relationships; this appears feasible and desirable.

Supply chain performance

Further to the points made that operations management and performance measurement should be more customer oriented, the supply chain management literature in chapter 5 identified (i) that the needs of the **end** customer should be considered and (ii) that recognition in the chain of end customer needs improves performance to end customers (Jones & Riley 1985). Christopher (1989 and 1992) further discussed the possibility of segmentation of end customers by these needs. A depiction of this is provided below in figure 7.2:

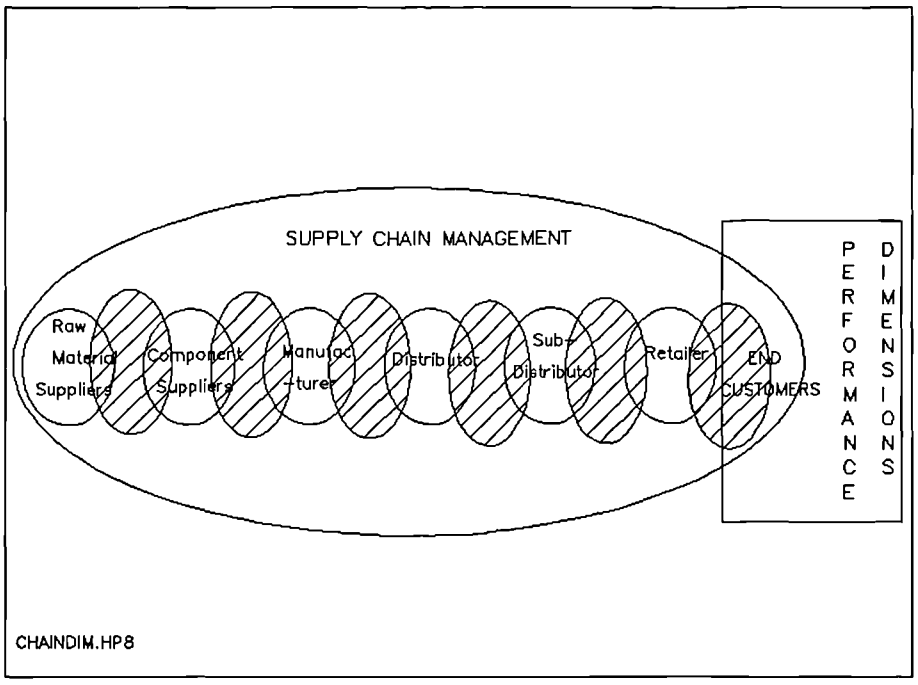


Figure 7.2: Dimensions of performance to end customer

However, these views were not empirically supported.

This highlights the following gap:

GAP 4

Despite the claims in the literature there does not, as yet, appear to be evidence to support that greater recognition of end customer needs in the chain improves performance to them

This gives rise to questions including:

QUESTIONS 4

Does improved visibility in the chain of end customers' needs impact on performance to them. Do all players in the chain need this visibility or only the supply chain manager? Is it beneficial to segment end customers by these needs?

This raises the following research issue.

RESEARCH ISSUE 4

Research could be undertaken to compare performance to end customers in chains where there was high visibility of their needs with chains where the players remained unaware of end customers needs.

There is some evidence of chains with high visibility of end customer needs e.g. Toyota chains in Japan (Womack et al 1990, Nishiguchi 1994). This appears a fascinating area to explore as "visibility" appears to be gaining credence. However, it appears fraught with problems to

operationalise as hypotheses. How would awareness of needs be assessed? What form would the visibility take - presence of visibility would not be a binary state. Different types of visibility could include soft, difficult to measure types such as a state of mind through publicity or could include hard types such as provision of end customer demand schedules up the chain.

Operationalising Supply Chain Performance Measurement

It has been identified in the literature that the needs of the end customer should be well understood by their immediate supplier Barnes (1987). Also, that supply chain co-operation would lead to improved performance in terms of customer satisfaction (Carlisle & Parker (1989). However, it is less clear what form this co-operation should take. This research is focused on supply chain performance, therefore co-operation regarding performance measurement is of interest.

Developing further the discussion of Slack (1991) on translating multiple external performance criteria to internal performance dimensions (discussed in chapter 6), this could be applied to supply chain management. The external performance dimensions (the end customer performance priorities) could be translated to "internal" performance dimensions within the supply chain at each link, as shown below in figure 7.3.

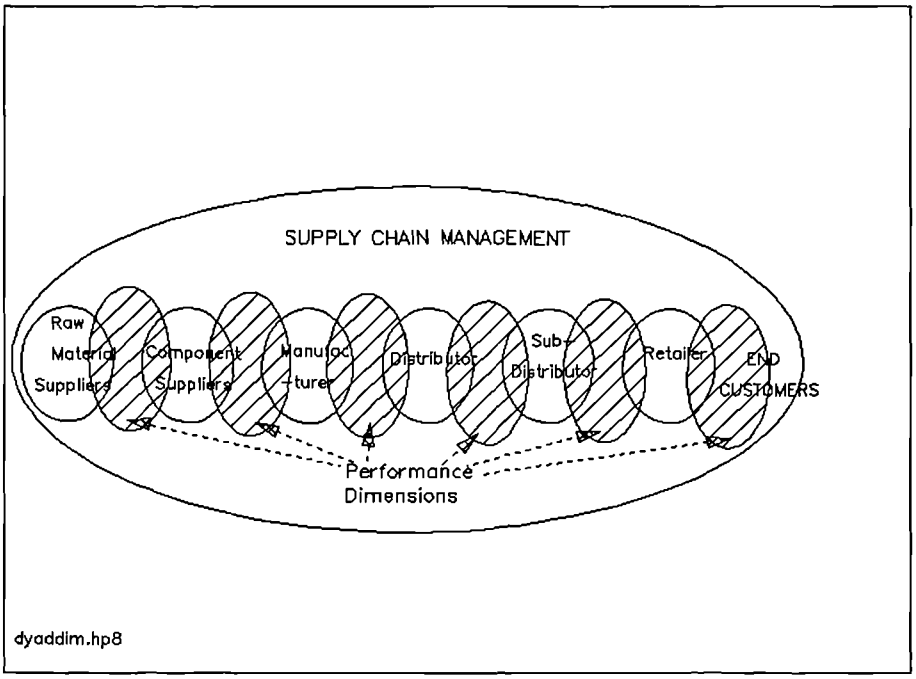


Figure 7.3: Dimensions of performance along the supply chain

However the following gap is evident:

GAP 5

There does not appear to be evidence of research performing this translation process to derive key dimensions of performance for each relationship

This raises the following question

QUESTIONS 5

Would performance measures in each chain relationship, related to the end customer, improve performance?

and the following research issue

RESEARCH ISSUE 5

If supply chains were available which had translated performance dimensions related to end customer needs already in place, the performance to the end customers could be compared (subject to the removal of other effects) to chains which did not have such measures in place. However, there is no evidence of such supply chains. To perform the research currently would involve deriving and implementing these measures then longitudinally tracking performance to end customers. This is not feasible here.

Position in chain

Hayes & Wheelwright (1984) identified the implications of position in their commercial chain relating to (i) demand volatility, (ii) asset intensity, (iii) profitability, (iv) technological change and (v) scale and balance.

Lamming (1993) identified the role of players in different positions in the chain in the product development process, in the investment in technology and in cost transparency.

Nishiguchi (1994) identified that tiers of subcontractors in collaborative manufacturing had greater stability in contractual relations, and improved growth performance.

It was identified in Chapter 3 that Operations Management focus for considering position in the chain had predominantly been on planning and control aspects of the relationships in its work on:

(i) inventory management (see for example Jones & Riley 1985, Stevens 1989 and Houlihan 1987)

(ii) Just-In-Time (Hayes 1981, Ohno 1978, Shingo 1985, Hahn et al 1983, Bartholomew 1984, Hall 1983 and Harrison 1993)

(iii) Distribution Resource Planning (for example Martin 1983, Stenger & Cavinato 1979, Stanley 1991)

(iv) Service chains (see Barnes 1987)

Similarly, the engineering perspective through the work on industrial dynamics had also focused on planning and control aspects relating to position in the chain (see Forrester 1961, Towill 1982, 1991 and 1992, Edghill et al 1988, Burbidge 1961, 1984, Stalk & Hout 1990 and Coyle 1982).

Likewise much of logistics work had concentrated on, what operations management would term, planning and control (see Bowersox 1969, 1978, 1986, 1989 and 1992,

Christopher 1969, 1971, 1979, 1985, 1989 and 1992), La Londe 1989 and Sharman 1984).

The operations management, logistics and industrial dynamics work has identified the link between chain position and planning and control. Industrial dynamics have empirically proven this effect and contributed the **Forrester effect** of demand distortion amplification being related to chain position.

Hayes and Wheelwright Decision Area	Observations on position in chain
Capacity	H & W (v) Scale and balance
Facilities	H & W (ii) Asset intensity
Equipment & systems	H & W (iv) Technological change. Lamming's investment in technology.
Internal / external sourcing	Nishiguchi's stability of contractual relations
Human resource & organisation	
Quality systems	
Planning and control	H & W (i) Demand volatility, Forrester effect
New product development	Lamming's lean supply roles
Performance measurement	H & W (iii) Profitability, Lamming's cost transparency. Nishiguchi's growth performance in tiered subcontracting

Table 7.1: Location of work on position in chain in Hayes & Wheelwright decision making areas

Using, once again, the Hayes & Wheelwright (1988) framework of decision making areas, it can be seen in table 7.1 above that these literature contributions relate to the categories identified.

Therefore, the following gaps in the literature can be observed:

GAP 6

There appears to be little empirical evidence generally of the implications of position in chain, apart from the well proven Forrester effect of industrial dynamics. Little work is apparent considering the implication of position in chain and particularly (i) human resource & organisation (ii) quality systems (iii) performance measurement

This gives rise to many potential research questions, of which only some can be discussed here:

QUESTIONS 6

Should different approaches to human resources and organisation be taken, depending on position in chain; for example, would team approaches be beneficial in the supply and manufacturing ends of the supply chain, more than downstream? Would secondment of people into downstream chain players for co-ordination of logistics be beneficial? Would

these people approaches be beneficial throughout the chain or only in parts?

Is TQM activity more likely to occur upstream or downstream of manufacturers in supply chains? Is there a role for supply chain TQM?

Is performance measured in chains related to end customers or does a "Chinese Whispers" effect cause upstream performance measurement to be in conflict with end customer satisfaction?

Is it desirable and feasible for supply chain managers to design and implement measures of performance for each player in their chain?

These give rise to many research issues including:

RESEARCH ISSUE 6

More research in supply chains relating position in the chain to approaches to input management, process management and output performance would provide greater understanding to supply chain managers about roles of chain players. This information may help them to manage the chains more effectively.

However, such research would necessarily involve facilitating access to companies connected by exchange but not necessarily by equity control. It

is unlikely that this could be facilitated by anyone other than the potential chain manager or key player in the chain. The nature of this research would therefore be limited by the access.

The scale of this multi-organisational research is large and the nature of the research complex. Many of the potential research questions asked above are almost impossible for research organisations to tackle because of the resource implications.

With the state of knowledge in supply chain management being new and generally underdeveloped, it would be overly ambitious to attempt to tackle some of these questions on chains.

However, if it was possible to design research on position in supply chains which had a tight, less ambitious focus; this would be desirable.

The Network Context

It was identified in Chapter 3 that competitive advantage could be gained by creating and harnessing the resource potential of the network in a more effective manner than competing firms; also, that the network perspective can influence competitive behaviour (Cunningham 1990). He identified the following as important:

- selection of collaborative partners in the network

- establishing a competitive position in the network

- monitoring yours' and competitors' positions in the network

- how the network relationships are handled

Others support the view that competitive behaviour can be influenced by the network perspective (see Hakansson 1987, Gadde & Matteson 1987, Easton & Quayle 1990 and Lamming 1993).

The industrial economists, notably Williamson (1985, 1986) have explored the structure / conduct / performance links at the level of the market. The lean production / lean supply work (notably Womack et al 1990, Lamming 1993 and Nishiguchi 1994) identified that leaner, more focused networks, such as the Toyota network, showed evidence of improved performance.

However, the literature in the area of firms' networks is still new and evolving. There is little evidence currently on what is good network performance, how companies should monitor theirs' compared to their competitors' and what measures are appropriate.

Therefore, the following gap is identified:

GAP 8

The literature appears underdeveloped in understanding network performance at the level of a focal firm's network. Initial evidence supports leaner, more focused structures supported by strategies formulated by a key player but relative performance of different types of network have yet to be established.

This gives rise to many research questions, including the following:

RESEARCH QUESTIONS 8

Are leaner networks more likely to give rise to better performance that broader structures? If so, how lean should they be.

How independent should these lean networks be of competitors networks? What are the implications of trade-offs of shared knowledge vs. secrecy?

Should networks be uniformly lean or is it more beneficial to be lean in one part of the network, for example upstream to gain from knowledge sharing on product design, but broader at another, for example downstream to gain from logistics scale

economies. i.e. is lean good for all decision making areas at all parts of the chain?

Is it a pre-requisite that to have lean structures, certain types of relationship must exist between the players e.g. longer term formalised relationships such as comakership?

These lead to the following research issues:

RESEARCH ISSUES 8:

Research at the level of the network comparing operational performance of some network structures to others would help improve understanding of the appropriateness of different types of networks to different market situations. This could provide guidance to companies taking decisions on network strategy and structure.

However, lean networks have only been discussed in the literature relatively recently. There are notable examples in existence, such as Toyota, but there are not many which could be used for comparative research.

Comparative research of this type would be very large scale and fraught with problems of facilitation.

The Industry Context

Much of the research discussed in chapters 3 and 4 on intermediate types of relationships such as comakerships and partnerships (see, for example, Lamming 1989, 1993, Womack et al 1990, Griffiths 1992, Sabel et al 1987, Nishiguchi 1987, 1994, Ohno 1978, Shingo 1985, Hahn et al 1983) has been performed:

(i) in the automotive original equipment manufacture industry

(ii) in the component manufacturer / vehicle assembler relationship

This identifies the following gap:

GAP 9

The literature appears to be better developed in its understanding of relationships, chains and networks in the automotive industry and particularly better developed in its understanding of the component manufacturer / vehicle assembler dyad.

This raises the following research questions:

RESEARCH QUESTIONS 9

Are the lessons learned from the automotive industry transferable to other industries with different products, processes and industry structures? Are the

lessons learned from the component manufacturer / vehicle assembler dyad transferable to other relationships in the automotive industry?

This gives rise to the following research issues:

RESEARCH ISSUES 9

Research into relationships, chains and networks across different industries would help improve understanding of the effect of the industry context on the networks and chains within it.

The research issues are becoming increasingly complex and large scale moving out from the centre of the systems picture. This research area would necessarily involve characterisation of different types of industry, understanding the networks within them and a means for comparison between them.

Again, with the state of knowledge as it is this seems over-ambitious currently. It is over ambitious for this dissertation to tackle.

The Territory Context

Much of the recent literature on good practice in relationships, chains, networks and industries has been based primarily on Japanese practices (Womack et al 1990, Lamming 1993, Nishiguchi 1994, Hayes 1981, Ohno 1978,

Shingo 1985, Hahn et al 1983, Bartholomew 1984, Hall 1983 and Harrison 1993).

The literature review exposed the significance of cultural differences between territories (see Achrol et al 1983, Hakansson 1982, Lamming 1989 and 1993, Gladwin & Walter 1980, Bartlett & Ghoshal 1992, Ohmae 1989 and Klassen & Whybark 1994).

Networks of some exceptional companies outside Japan (for example, Benetton in Italy)[1] have been discussed, but the following gap has been observed:

GAP 10

The literature appears underdeveloped in its understanding of networks, chains, and relationships in countries other than Japan.

This gives rise to the following research questions:

RESEARCH QUESTIONS 10

Is good practice in networks, chains and relationships transferable across territories? How significant are the effects of culture, history, demographics etc relating to the territory on networks, chains and relationships within or partially within them.

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1 For further information on Benetton, see Dapiran 1994

This raises the following research issues:

RESEARCH ISSUES 10

Research comparing network, chain and relationship strategies, structures, and infrastructures across different territories would improve understanding of the influence of the territory effect. This would help operations managers and supply chains managers identify appropriate approaches for different territories.

As with research associated with the industry context, this is very large scale, very complex research which necessarily involves characterising different territories, characterising the networks, chains and relationships associated with them, then making comparisons across territories.

This area is further complicated by the fact that relationships, chains, networks and industries may span more than one territory. If Lamming's (1993) view of the relationship as a quasi organisation is accepted, what part of this quasi-organisation would be assigned to each territory?

This area of research is overly ambitious in the context of the state of knowledge in this area, the scale of the research, and the requirements of this dissertation.

Having identified gaps, research questions and research issues from the literature, the next section will draw these together to form a cohesive set of research hypotheses that are desirable and feasible for this dissertation to tackle.

DEVELOPMENT OF HYPOTHESES

The literature chapters and the above discussion have lead to a view in this research of the importance of understanding supply chains at the level of the relationships which comprise them, the chains themselves, and the network, industry and territory contexts within which they exist. The general view formed of desirability and feasibility of tackling research questions identified above is that, given the current state of knowledge and the constraints of this dissertation, research at the level of the territory, the industry and the network is not advisable here.

Therefore, this research will be focused at the levels of the chain and the relationships within the chains, with a view to improving knowledge about supply chain management at those levels. However, the effects of the network, industry and territory contexts cannot be ignored; this research must seek to limit the effects of influence exerted by these contexts.

Research Issue 3 above identified the potential value of research which improved understanding of expectations, perceptions of performance and satisfaction / dissatisfaction in relationships. Also it was identified that gaps between these may differ across different performance dimensions.

The literature related to this area, notably Parasuraman et al's 1988 gap model, identified different types of gaps. However, it was also reported that some difficulties had been found in applying the model. Also in chapter 6, this work criticised the model for its bias in the relationship - the customers' expectations **and** perceptions of performance were considered but only the suppliers' perceptions of customer expectations were considered i.e. the model failed to identify that suppliers have perceptions of performance as well.

Later work by Boulding et al (1993) identified different types of expectations, namely **will**, **should** and **ideal** expectations. However, is this view of expectations appropriate to this research? Supply chain management (i) involves more company to company relationships than company to consumer relationships and (ii) these relationships involve more interaction (Hakansson & Wootz 1979). Using customer **will**, **should** and **ideal** expectations as a standard in a gap model may not be as appropriate as identifying their **requirements**, where requirements represent the customer's desires, moderated by the

interaction. These requirements therefore are not **ideal** expectations which may be impossible but are more closely related to **should** expectations. Requirements would therefore represent a realistic desirable outcome for the customer.

It would appear to be a useful development of this gap model to consider, therefore, the following gaps:

1. The gap between the customer's expression of their requirements and the supplier's perception of their requirements - this represents a misperception of requirements

2. The gap between the customer's perception of performance and the supplier's perception of performance - this represents a misperception of performance

3. The gap between the customer's requirements and their perception of performance - this represents customer dissatisfaction

4. The gap between the supplier's perception of customer requirements and the supplier's perception of performance - this represents the supplier's perspective of customer dissatisfaction i.e. their recognition of a performance gap

Of these gaps, it could be argued that the third is the most important as it represents customer dissatisfaction. Closeness in the relationship in terms of understanding of requirements and performance is of little value if, despite this, the customer perceives a gap between what they want and what they get and is therefore dissatisfied. Also, it should be highlighted here that this gap may not be "real" in that "actual" performance may be very different to that perceived by the customer.

In addition, it could be argued that the fourth gap is different to the others, as it does not involve the customer. This gap is of interest to help identify the likelihood of a supplier improving to satisfy customers; if the supplier is unaware of a performance gap, he will not be motivated to close it. Also if the content of the performance gap he recognises is different to that recognised by the customer, despite any motivation to close his gap, the efforts will not improve customer satisfaction.

The desire to develop knowledge further on these gaps in relationships will now be used to formulate null and alternate hypotheses for this research.

HYPOTHESIS 1

H_0 There is no significant difference between the size of different types of gaps in the chains studied

H_1 A significant difference exists between different types of gaps between customers' and suppliers' perceptions of requirements and performance

HYPOTHESIS 2

H_0 A significant relationship does not exist between the extent of misperceptions and the extent of customer dissatisfaction in relationships

H_1 A significant relationship does exist between misperceptions and customer dissatisfaction

This can be divided into:

HYPOTHESIS 2a

H_0 A significant relationship does not exist between the extent of misperceptions of requirements and the extent of customer dissatisfaction in relationships

H_1 A significant relationship does exist between misperceptions of requirements and customer dissatisfaction

and

HYPOTHESIS 2b

H_0 A significant relationship does not exist between the extent of misperceptions of performance and the extent of customer dissatisfaction in relationships

H_1 A significant relationship does exist between misperceptions of performance and customer dissatisfaction

HYPOTHESIS 3

H_0 There is no significant difference between the gaps between customers' and suppliers' perceptions of requirements and performance associated with different performance dimensions

H_1 There is a significant difference between the gaps between customers' and suppliers' perceptions of requirements and performance associated with different performance dimensions

These hypotheses fit together to provide a research direction at the level of the relationship. However, rather than focus only on relationships, to give the research a supply chain focus, it will be attempted to tackle the question of the relation of position in chain, as indicated in research issue 6. To tightly integrate this with the previous hypotheses, the following hypothesis will be tested:

HYPOTHESIS 4

H_0 The amount of misperception and customer dissatisfaction does not relate to the position in the supply chain; upstream relationships will not exhibit significantly more misperception and

customer dissatisfaction than downstream relationships

H_1 **The amount of misperception and customer dissatisfaction does relate to the position in the supply chain; upstream relationships will exhibit significantly more misperception and customer dissatisfaction than downstream relationships**

This can be sub-divided into:

HYPOTHESIS 4a

H_0 **The amount of misperception of requirements does not relate to the position in the supply chain; upstream relationships will not exhibit significantly more misperception of requirements than downstream relationships**

H_1 **The amount of misperception of requirements does relate to the position in the supply chain; upstream relationships will exhibit significantly more misperception of requirements than downstream relationships**

and

HYPOTHESIS 4b

H_0 **The amount of misperception of performance does not relate to the position in the supply chain; upstream relationships will not exhibit significantly more**

misperception of performance than downstream relationships

H_1 The amount of misperception of performance does relate to the position in the supply chain; upstream relationships will exhibit significantly more misperception of performance than downstream relationships

and

HYPOTHESIS 4c

H_0 The amount of customer dissatisfaction does not relate to the position in the supply chain; upstream relationships will not exhibit significantly more customer dissatisfaction than downstream relationships

H_1 The amount of customer dissatisfaction does relate to the position in the supply chain; upstream relationships will exhibit significantly more customer dissatisfaction than downstream relationships

Having identified gaps in the literature, drawn out research issues and formulated research hypotheses for this piece of research, the following section considers the potential implications of this research.

CONCLUSIONS OF THE POTENTIAL IMPLICATIONS OF THE RESEARCH

CHAPTER 7

It is evident from the literature reviews and from the development of research issues and hypotheses for this research that to date the work on supply chain management is patchy and is clustered in three main groups.

Group 1: Work on relationships and partnerships at the component manufacturer / vehicle assembler dyad (for example, Lamming 1987a, 1987b, 1989, 1990, Griffiths 1992, Sabel et al 1987, Nishiguchi 1987, 1994, Ohno 1978, Shingo 1985, Hahn et al 1983)

Group 2: Work on planning and control aspects of chains (for example Jones & Riley 1985, Stevens 1989, Houlihan 1987, Hayes 1981, Ohno 1978, Shingo 1985, Hahn et al 1983, Bartholomew 1984, Hall 1983, Harrison 1993, Martin 1983, Stenger & Cavinato 1979, Stanley 1991, Barnes 1987, Forrester 1961, Towill 1982, 1991, 1992, Edghill et al 1988, Burbidge 1961, 1984, Stalk & Hout 1990, Coyle 1982, Bowersox 1969, 1978, 1986, 1989, 1992, Christopher 1969, 1971, 1979, 1985, 1989, 1992, La Londe 1989 and Sharman 1984).

A third group, identified in chapter 4 which developed a holistic definition of supply chain management, is less

well established and less clearly focused but it does contain work which has tended to take a broader, more strategic view of supply chain management and includes:

Group 3: Womack et al 1990, Lamming 1993 and Harland (Jones) 1989, 1990a, 1990b, 1990c, 1993.

This piece of research will contribute to the limited empirical work currently present in that third group. Buffa (1980) highlighted the tendency for operations management researchers to consider sub-systems rather than take a holistic view of the whole system. Adding to work in this third holistic group will address this criticism. The nature of this work is such that it should add to knowledge, rather than apply a particular OR technique; this addresses criticisms of operations management research made by Voss (1984) and Chase (1980).

Uniquely, this piece of research will:

(i) add a different perspective to the work on relationships by applying gap analysis from the service management area to compare expectations with perceptions of performance

This may help to integrate relatively separate literatures.

(ii) add to the knowledge on relationships by comparing customers' perceptions with suppliers' perceptions

This will highlight possible inadequacies of other research which has performed gap analysis pre-dominantly from the supplying organisation's perspective rather than truly observing from both dyad parties' positions equally.

(iii) add to knowledge by testing if customer dissatisfaction is correlated to misperceptions of suppliers

From an organisation's point of view this could be very significant. If it were proven that suppliers' misperceptions of either the customers' requirements or the customers' perception of performance had a consequential impact on customer dissatisfaction, there would be obvious consequences for forming a common understanding with the customer on these aspects

(iv) reinforce other work which has shown that customers requirements for and their perception of performance against each dimension are not equal

This would be of particular value to the companies involved in the research but generically would further

support the need to (i) understand different customers' requirements and (ii) gain this understanding at the level of separate dimensions of performance, rather than an aggregate level of performance.

(v) most importantly, provide a novel dimension to the significance of position in the supply chain i.e. its affect on satisfaction

This would be the main contribution of the work as it would satisfy several operations management imperatives already identified.

1. To be more customer oriented

2. To be more oriented towards external performance

3. To break out of the mould of focusing only on the manufacturer (production management) or only on the consumer (service management)

The next part of this dissertation considers appropriate research methodology to test these hypotheses.

CHAPTER 8 - RESEARCH APPROACHES, PARADIGMS, METHODOLOGIES AND METHODS

SUMMARY

This chapter reviews and classifies ways of doing research into approaches, paradigms, methodologies and methods.

Following an introduction, the next section considers research approaches, the term approach being used here to describe a high level construct to characterise a researcher's viewpoint. Here distinctions between science and social science, hard and soft, formal and informal, quantitative and qualitative, and rational and existential are made.

The next section considers research paradigms and examines functionalism, interpretive and radical / critical paradigms.

Following that is a section on research methodologies which considers empiricism, hermeneutics and critique.

Next is a section on research methods which examines methods of direct observation, people's perceptions and artificial methods.

It is shown that there are logical groupings of approaches, paradigms, methodologies and methods; some have been presented as **integrative frameworks** for research; these are considered here.

The chapter concludes that the research design for this piece of research should be cognisant of the philosophical underpinnings and the appropriateness of particular approaches, paradigms, methodologies and methods. It is deduced that the nature of the research hypotheses indicates that the approach should be social science rather than science oriented, primarily qualitative, (though this would not preclude quantitative analysis) and more rational than existential. The functionalist paradigm and empiricist methodology associated with that paradigm appear more appropriate to these particular hypotheses. This indicates the relevance of structured interview or questionnaire and a case is put forward why semi-structured interviews are appropriate.

Only 1% of operations management publications have adopted this particular mode of research, the vast majority tending to be artificial reconstruction of object reality (Meredith et al 1989).

INTRODUCTION

There appear to be different uses of each of the terms approach, paradigm, methodology and method in the literature and there is no apparent agreement on the meaning of each of these terms. Whilst it is not appropriate for this dissertation to attempt to further knowledge on research methodology, it is appropriate to clarify the definitions adopted here to enable discussion later regarding the reasons behind the choice of a particular research design for this piece of research.

Defining Research Approaches

The term **approach** has been used variously in the literature; it is difficult to describe what is meant by the term. Some authors, e.g Meredith et al (1989) have used the term to relate to a high level of generality referring to, for example, the philosophical approach.

Approach doesn't appear to have a generally recognised standing as a research act, or condition, or means but it is used frequently when referring to research. For example, Morgan (1983) described 21 different approaches to social science research and expanded on them to identify and characterise the logics or strategies within them, providing a framework to structure them. It appears as though many authors associate with the term approach when writing about research but seldom attempt to define it expressly.

Defining Research Paradigms

There seems to be less disagreement in the literature regarding the definition of a research paradigm. Oliga (1988) expresses the view that a paradigm is defined by the **"constitutive ontological assumptions regarding the researcher's view about the existential nature of the social world and human subjectivity"**. Rosenhead (1989) describes a paradigm as consisting of a set of implicit rules for identifying a valid scientific problem and for recognising what would constitute a solution to it.

Meredith et al (1989) define a research paradigm as being a **"set of methods that all exhibit the same pattern or element in common"**. The difficulty with this definition is identifying what they mean by the term **method**. They develop a framework for research methods, describing case studies as methods, but then switch, without reason or justification, to calling them methodologies. Therefore, it is unclear whether they consider a research paradigm as a set of methods or methodologies.

The research literature appears to view a paradigm as being a set of rules which may be subjective; however, it does seem possible to characterise a paradigm, giving some structure to the subjectivity.

Defining Methodologies and Methods

There appears to be significant controversy regarding the definitions of **methodology** and **method**. The two terms are

used by many synonymously, therefore their definitions will be treated together here. Originally, methodology referred to the science or study of method; definitionally, over time, the term has become used to describe the system behind method in a particular discipline. Avison and Fitzgerald (1988) express the view that a method is like a recipe and is a collection of procedures, techniques, tools and documentation aids; a methodology is, they claim, usually based on a philosophical view. For example, one methodology may emphasise human issues and interpretation whereas another may be more scientific and clinical in its view. Oliga (1988) defines methodology, as opposed to method, as a higher order construct. Oliga considers methods to be research techniques, such as case studies or questionnaires. Methodologies are the propositions and assumptions behind methods; these propositions and assumptions are necessarily normative which is why hard scientists find them meaningless, refusing to accept that there is a theory behind knowledge, rather than just knowledge itself.

It would appear that there is disagreement in the literature on what is being referred to by these terms; however, the terms "paradigm", "methodology" and "method" have been used with some agreement and, providing users of the terms make their definitions expressly clear, they could be used without too much confusion. However, the term "approach" has no clear meaning at all in the

research methodology literature. It will be used here, however, to refer to a higher level construct than a paradigm to indicate where a researcher is coming from i.e. their viewpoint. The distinction provided in this chapter is in terms of level of construct from high to low:

HIGH

Approach

Paradigm

Methodology

Method

LOW

An example will be used to help describe the definitions for this piece of research.

> A social science **approach** could be taken for a piece of research, with an underlying set of assumptions or a **paradigm** based on the belief in interpretive subjectivity which could be investigated using the **methodology** of hermeneutics to interpret the actions of men and women. The **method** used may be unstructured interviews.

Having defined the terms to be used for this piece of work, available approaches, paradigms, methodologies and methods will now be considered to identify which appear more appropriate to research the hypotheses provided in the previous chapter.

AVAILABLE APPROACHES, PARADIGMS, METHODOLOGIES AND METHODS

Available approaches

There are a range of views in the literature about different research approaches. The approaches discussed here distinguish between scientific research, social science research and organisational research. In addition the distinction between quantitative and qualitative approaches is discussed as is the distinction between rational and existential.

Science, Social Science and Organisational Approaches

To distinguish between science, social science and organisational study, Bryman (1989) described the meaning of each of these. Science is based on the fundamental belief in hard facts; scientific knowledge is increased by investigating a one true reality. Social science does not believe in one hard truth but rather believes in different perceptions of and influences on situations. Organisational study is a particular area of social science, in that it recognises the influence of and the perceptions of people, but it contains certain characteristics particular to studying organisations as opposed to researching in the community.

Social sciences developed as a field of study later than natural sciences. Research in social sciences tended to

adopt a scientific approach and scientific methods as used in studying the natural sciences. Even though today the field of social science is well established, the majority of social science research continues to try to apply a scientific approach even though the object of enquiry is significantly different (Oliga 1988).

A scientific approach is based on the concepts of repeatability, reductionism and refutability (Checkland, 1981b). Bryman (1989) provides a discussion of the scientific approach as comprising:

1) Hypotheses which are derived from theory and which can be measured by observing the behaviour of certain variables.

2) The belief in causality which involves observing effects on dependent variables as independent variables change, with an underlying implication that the independent variable/s caused the observed changes.

3) The extension of particular results by generalising to offer some laws about reality.

4) The belief in replicability - a different researcher should be able to generate the same or very similar results using the same methods. Replication not only checks the validity of the

results of previous research but it also checks their generality.

A Social Science approach recognises the impossibility of guaranteeing repeatability, reductionism and refutability in the context of a social world. As too does Organisational Study, but in addition to the complexity of the social nature of social science research, Organisational Study recognises that accessibility to researching the problem is a critical feature of this approach (Bryman 1988a). i.e. gatekeepers in organisations bar the way to speaking to key people; also sensitivity of confidential corporate information may prevent access to research data.

It could be argued from this that Organisational Study does not seem to be an approach so much as a problem context which brings with it a set of peculiar research difficulties and characteristics. The reason for making a distinction here is to clarify that Social Science is widely recognised as having fundamentally different characteristics to Scientific research and that Organisational Study has some peculiar characteristics not exhibited by the rest of Social Science research.

There has recently been concern expressed in some business disciplines about the preponderance of researchers to be scientific in their approach. When

referring to the information systems field, Galliers & Land (1987) termed it:

> **"an applied discipline, not a pure science. It follows, therefore, that if the fruits of our research fail to be applicable in the real world, then our endeavours are relegated to the point of being irrelevant"**

In the operations management area, the scientific approach has been criticised by several authors who have questioned whether the findings of scientific research in operations management have been of any value to operations managers in practice (see, for example, Buffa 1980 and Miller & Graham 1981). Meredith et al (1989) ascribed the tendency to be scientific as originating in "the heritage and history of operations management" which, as was shown in chapter 1, has been based on Taylorism and operations research. Flynn et al (1990) proposed that the continuation of the scientific approach in operations management was caused by a desire for "respectability" on behalf of the researcher.

However, the research hypotheses for this piece of research explicitly recognise that there is not one true reality as they intend to investigate customers' and suppliers' perceptions, rather than search for one truth or actual reality.

Also, it was identified in chapter 2 that the literature highlighted the significance of the network context on competitive behaviour in supply chains and in chapters 3 and 4 that performance in relationships should be viewed as specific to that relationship. These points highlight that this research will therefore be context specific and would not be easily repeatable in other supply chains. The same methodology could be adopted but the research findings are likely to be different, depending on the supply chains chosen for the research.

Both the belief in the significance of different perceptions of a situation and the difficulty in repeating the research and expecting the same results indicate that this research is adopting a social science approach.

The peculiarities of organisational study within the social science area also appear to apply to this piece of research. A key feature of organisational study is the recognition of the difficulties of access when researching the problem. These difficulties are multiplied when researching supply chains as collaboration and co-operation are required by the players in the supply chain. The research issues raised in chapter 6 identified that most research attention had been paid to vertically integrated chains; access to a vertically integrate chain is through negotiation with one company, albeit in different locations. However, it

was identified that more research was required in non-hierarchical chains; therefore access becomes far more difficult when attempting to gain the co-operation of these different companies involved in the non-hierarchical chains.

Having identified that this research is to adopt a more social science approach, cognisant of the difficulties of the problem context of organisational study, the next section discusses whether the approach should be qualitative or quantitative.

Qualitative and quantitative research approaches

The terms **qualitative** and **quantitative** are used in different ways by different authors. Some authors e.g. Morgan and Smircich (1980) believe that the distinction between qualitative and quantitative is far more than merely the distinction between methods of data collection. Rather, they express them as being different epistemological stances i.e. different approaches to what constitutes knowledge. They contest that quantitative research supports the belief in the applicability of the natural science model to social research whereas qualitative research opposes this view. Bryman (1989) describes this as:

> **"Whereas quantitative research is viewed as suffused with a commitment to the natural sciences, qualitative research is depicted as embracing a**

different epistemological position that entails a rejection of the scientific method by virtue of an espousal of the notion that people are fundamentally different from the objects which constitute the natural scientists' subject matter. This distinctiveness of people and social reality, as against the natural order, reveals itself in the capacity of people to attribute meaning to and interpret their social environment and to be active in the construction of that environment, so that the social world is not simply an inert system of regularities waiting to be revealed."

From Morgan and Smircich (1980) and Bryman's (1989) views, it could be concluded that quantitative research treats facets of the environment as objects like physical or biological matter whereas qualitative research explores people's understanding of their environment.

Supporters of the scientific approach consider qualitative research to be merely a collection of methods, rather than a different epistemological position. Bryman (1989) makes it clear that the distinction between quantitative and qualitative should not be taken to be the presence or absence of quantification. He points out that qualitative researchers are not averse to quantifying their data, analysis and findings.

This research is social science rather than science oriented, and, by virtue of its hypotheses, is an investigation of people's perceptions. This matches Bryman's view of a qualitative epistemological stance in that it recognises people's ability and tendency to interpret their social environment and to be active in the construction of that environment. The comparison of different parties' perceptions of the same issues is not in accord with a quantitative epistemology of **"an inert system of regularities waiting to be revealed"** (Bryman (1989).

Meredith et al (1989) criticised operations management research for its focus on quantitative rather than qualitative research; they described a

> **"virtually overnight reorientation of the field to an analytical approach based on quantitative modelling".**

Andrew & Johnson (1982) attribute this largely to the Operations Research influence on the subject which was identified in chapter 1 as being a major feature in the development of operations management.

Therefore it appears appropriate for this research to be qualitative rather than quantitative in its orientation because of, most importantly, the nature of the research hypotheses but also because of the lack of qualitative

research in the subject, relative to the volume of quantitative research. However, as Bryman (1989) identified, this does not necessarily preclude some quantification of data within the research.

Continuing the theme of appropriate research approaches for this research, the next section considers whether the research should adopt a rational / deductive approach or an existential / inductive approach.

Rational/ Deductive and Existential/ Inductive approaches

Meredith et al (1989) discussed the rational / existential dimension of research where rational and existential are at opposite ends of a spectrum. **Rational** research is where the research seeks a pure logical truth, independent of man. **Existential** research is where the researcher believes that truth can only be defined relative to individual experience. They identified that rational research uses a formal structure and that pure knowledge is deduced. At the other polar extreme, existential research has as its basis the induction of knowledge from an individual's unique capabilities in concert with the environment. Existentialists support the view of an individual trying to make sense of a seemingly meaningless world. Between these two polar extremes lie intermediate views supporting varying degrees of some rationality and logical structure and some individual induction of knowledge.

Meredith et al (1989) identified that most operations management research has tended to be more rational than existential in its approach; they expressed the view that it was easier for operations management researchers to assume a more rational view than a more existential view as it was simpler to research. Mintzberg (1983a) highlighted that existential research requires **"detective work"** and then a **"creative leap"** to generate findings and any conclusions which add to knowledge. Andrew & Johnson (1982) expressed the view that this approach was viewed as being quite risky by operations management researchers whereas a rational view was a safer approach.

Whilst not intending to explore the individual and why an individual's perception should be in a particular state, or even to interpret **why** a group of individuals in a company should exhibit particular perceptions, this research does intend to explore and compare different perceptions. It could therefore be viewed that the approach is not entirely rational but is certainly not existential; given a linear dimension from rational to existential, this research would probably lie nearer to the rational end of the scale than the existential.

It appears that whether distinctions and comparisons are being made between **science** and **social science**, **qualitative** and **quantitative**, **rational** and **existential**, underneath are essentially the same issues i.e. hard, irrefutable, objective truth which, if investigated

properly, will be apparent to the researcher vs. soft, socially influenced, subjective reality which is perceived by researchers. It appears that many researchers in social science have adopted harder, more rational, scientific research but that it is more widely recognised now that the social world cannot be treated quite that clinically.

Continuing with the definitional quest, within approaches the available underlying sets of rules or **paradigms** will now be considered.

Available Paradigms

There are many different classifications and definitions of research paradigms - see for example Hirschman & Holbrook (1992), Burrell & Morgan (1979), Morgan (1983), Oliga (1988) and Morgan & Smircich (1980). Whilst it is not the intention to criticise the theory on research paradigms here, it is necessary to adopt an acceptable categorisation for use in consideration of an appropriate paradigm for this research.

There is support in the literature (see Oliga 1988 and Giddens 1977) for Habermas' (1972) Interest Constitution Theory. Habermas identified the linkages between the type of interaction (man-nature, man-man or man-self), the underlying paradigm (functionalist, interpretive or radical / critical) and the methodological approach (empiricism, hermeneutics or critique).

In this section the three paradigms identified by Habermas will be discussed i.e.

- functionalist
- interpretive
- radical / critical

The **functionalist paradigm** is objectivist and seeks to provide explanations of society; the type of interaction in this research is **man-nature.** It assumes the presence of rules and formal procedures, such as lot sizing rules in operations management, and the applicability of scientific principles. Meredith et al (1989) identify the axiomatic work of operational research, such as more variations on the economic order quantity model, as requiring the presence of formal procedures and characterisable by scientific management principles.

The **interpretive paradigm** is subjective in its quest to explain social order and the status quo and therefore involves interaction of **man-man.** Meredith et al (1989) explain:

> **"the interpretive perspective includes the context of the phenomenon as part of the object of study. Interpretive researchers study people rather than objects, with a focus on meanings and interpretations rather than behaviour"**

The **radical / critical paradigm** does not seek to explain but rather to question and criticise society; the type of interaction can therefore be described as **man-self.** Meredith et al (1989) reported little evidence of this paradigm in operations management research.

Researchers adopting this particular paradigm believe that, by exposition of a situation to its participants that the participants will be able to help themselves.

As with any operations management research it is possible to research supply chain management adopting any of these paradigms. What is important here is to identify the appropriate paradigm for this particular study.

The hypotheses for this research are formulated in a way that involves the researcher observing parties in a supply chain. For this research it is assumed that the researcher will be objective in that observation. There is no interpretation of the views of the parties in the supply chain, only collection of their views and comparison. There is also no participation required by the players in the supply chain to evolve the views; nor are these views used to develop the participants in a self-help exercise.

Therefore the objective, observation type of research implies a functionalist paradigm. The lack of

interpretation of views and of participants introspectively examining the supply chain show that both an interpretive and a radical / critical paradigm are not appropriate here.

Research paradigms imply different methodologies (Oliga (1988); the available methodologies will now be discussed.

Available Methodologies

Oliga (1988) identified three main methodological foundations:

- Empiricism
- Hermeneutics
- Critique

Each of the methodologies will be briefly described here.

Empiricism

Empiricism is based on the functionalist paradigm. It assumes that the world is made up of hard social structures which can be studied; there are variants of empiricism of which positivism is the most widely recognised and adopted.

Positivism believes scientific knowledge to be made up of the aggregation of empirical knowledge based on observed phenomena.

Structuralism believes that empirical, or observed events, are only part of knowledge, the rest being made up of unobserved events and what potentially could have happened.

Underlying the empirical approaches of positivism and structuralism is an assumption that the researcher can be objective and not influence findings with his or her own values.

Hermeneutics

Hermeneutics is based on interpretation. The foundations of hermeneutics are very different to empiricism in that instead of believing in the existence of hard structures and the ability of the researcher to objectively study them, rather the world is taken as being a social world of subjective meaning and subjective intentions. Social phenomena require interpreting to try and find out why and how they occurred or, as Bauman (1978) described it, to retrieve the purpose, intention and "the unique configuration of thoughts and feelings which preceded the social phenomenon and found its only manifestation, imperfect and incomplete, in the observable consequences of action".

If, in social science research, the observable consequences **are** imperfect and incomplete, and are the

results of the actions of men and women, then any generic causality becomes difficult to identify.

As well as the subject area being difficult to study, the researcher brings to the situation his or her own set of values, traditions, experiences etc. Bleicher (1980) highlights that the interpreter already has a pre-understanding of the object of study and cannot approach it with a neutral mind. As well as making objectivity difficult, this also makes repeatability difficult in social science research.

Weber (1949) attempted to bridge the gap between objectivity and subjectivity so that social science could build foundations of knowledge which were objectively valid. As well as Weber's work, Burrell and Morgan (1979) describe and analyse the work of authors including Dilthey (1976) and Bleicher (1980) who sought to develop an objective science of sociology which would satisfy the requirements of positivist science.

Hermeneutics is, therefore, the methodological response to the interpretive paradigm.

Critique

Critique (or critical hermeneutics) involves making the individual and social processes transparent and open to criticism to enable change through self help. Bleicher (1980) describes critique as being based on the model of

psycho-analysis (probably to explain it to American readers) where the patients have their symptoms relieved through causal explanation and deeper self-understanding.

Oliga (1988) explains how, by including both explanatory and interpretive tasks, critique raises concerns with approaches reliant solely on either explanation (i.e. empiricism) or interpretation (i.e. hermeneutics). Critique also comes armed with the assumption that change should occur.

It was identified previously that the functionalist paradigm is appropriate for this research; the methodological foundation related to functionalism is empiricism, therefore empiricism is the appropriate methodology for this work.

The discussion thus far has identified that researchers, depending on the underlying orientation to a particular approach, the underlying paradigm and the methodological stance adopted, will therefore influence the methods used to perform research. The next section considers the available methods.

Available Methods

Rather than describe all the available research methods here in detail, the main purpose of this section is to list them and provide a **brief** description of each, enough to be able to distinguish between them and make an

appropriate choice for this work. In the following section, titled **Integrative Frameworks for Research**, various authors groupings of and opinions on relevant methods for certain methodologies, paradigms and approaches will be discussed.

The following list provides most of the main research methods compiled from lists compiled from Ein-Dor & Segev (1981), Bryman (1989) and Meredith et al (1989) and includes:

(i) Field studies
(ii) Structured Observation
(iii) Field Experiments
(iv) Action Research
(v) Case Studies
(vi) Structured Interviewing
(vii) Surveying
(viii) Historical/ archival analysis
(ix) Delphi
(x) Unstructured Interviewing
(xi) Expert Panels
(xii) Futures research/ Scenarios
(xiii) Introspective reflection
(xiv) Logical Deduction
(xv) Normative analytical modelling
(xvi) Descriptive analytical modelling
(xvii) Prototyping
(xviii) Physical Modelling

(xix) Laboratory experiments

(xx) Mathematical simulation

(xxi) Conceptual modelling

Brief descriptions of each of these will now be provided.

Field Studies

Using this method, sites for study are carefully selected to examine one or more factors; no attempt is made by the researcher to intervene or manipulate the factors at the time of observation or analysis.

Structured Observation

This is similar to a field study but here the researcher has a pre-defined schedule of observations to make or particular things at particular times.

Field Experiments

Here the important field site variables are under the control of the researcher; the independent variables are altered and the resulting effect on dependent variables observed.

Action Research

Here the researcher becomes involved and attempts to influence the situation while observing the effects on dependent variables. The researcher therefore becomes part of the field of investigation.

Case Studies

The research here is intensive and may be focused on only one site over a period of time. Independent and intervening variables are not controlled but outcomes and processes are observed and measured in detail, often by using various sources of data.

Structured Interviewing

Whilst having similarities to field studies and case studies, data is collected only during the interview. Analysis of this may be done from recordings and/ or transcripts of the interviews. An advantage of structured interviewing is the interviewer's ability to control the situation and responses; however, this brings with it the issue of subjectivity as it is possible to lead the interviewee. The results can be analysed non-quantitatively or quantitatively looking for clusters etc.

Surveying

This is more time efficient than interviewing and therefore allows greater sample size to be investigated with limited resources. The difficulties associated with surveys, however, are:

- low response rates, particularly to postal surveys
- following up non-respondents

- following up to clarify or expand on information provided by respondents
- reliability and validity of the test instrument

Historical/ archival analysis

This approach involves examining historical documents, existing statistics or recorded data to give some new insight, trends etc. No manipulation of variables is possible as the research is detached from the time of observation.

Delphi

Explicit well defined methods are used to gain information from a group of experts in rounds. Each expert provides information on the particular issue; the results are fed back to all the experts for the second round which develops the insights gained in the first round. The process may be repeated for several rounds before the entire learning is documented.

Unstructured Interviewing

Open ended questions are used to allow the interviewee to talk about the research issue; subsequent questions may be asked as a result of the interviewee's response. The advantages of unstructured interviewing are that it does not prevent the researcher finding out something which, prior to the interview, he or she was unaware of; it is therefore exploratory. However, it is difficult to

compare across interviews as they are likely to be different.

Expert Panels

As with Delphi, a set of experts are asked questions and commonalities and differences in responses are recorded and analysed.

Futures research/ Scenarios

Different world, market or company situations may be postulated, modelled and various "what-if" questions asked. This is used particularly for forecasting and long range planning.

Introspective reflection

Meredith at al (1989) identified this as being one of the more existential methods as it involves peoples perceptions of reality. Here the researcher reflects on their own experiences and therefore are researching their own impressions rather than someone elses. The problem of individual bias causes this to be discounted as a method by the scientific community.

Logical Deduction

Here a model of the object reality is built and subjected to tests which can be replicated by other researchers. The model is based on certain logic and/ or formulae, upon which its performance hangs.

Normative analytical modelling

Here recognised and accepted models or mathematical representations are used to give a prescriptive result. Some of the models may guarantee optimisation whereas other may not.

Descriptive analytical modelling

This is similar to normative analytical modelling in that a recognised model is used but, unlike the normative version, a prescription is not produced. Rather a description of the situation is the output.

Prototyping

This involves building a working model of a system which contains the key attributes; it is often used to pilot test a system that it being designed. Alternatively, it can be a full model or system which is run "off-line" to assess the effect prior to implementation.

Physical Modelling

Here the model is a physical representation, such as a scale model used by architects.

Laboratory experiments

Here the independent and intervening variables are held closely under the control of the researcher and the effects on the dependent variables systematically recorded. The Hawthorne experiments represent a social

science application of this method, used extensively by the scientific community.

Mathematical simulation

This is a special type of analytical modeling. Real data values may be used to set the parameters in the simulation. Either real data or test data may be used to represent the data flowing in reality e.g. arrival rates at a work station.

Conceptual modelling

A mentally constructed model is created then evaluated by means of some framework.

It has already been identified that the "choice" of methodology will be influenced by the methodological foundation, the paradigm and the underlying approach. This has lead to some authors forming what they see to be logical groups or integrative frameworks for research.

INTEGRATIVE FRAMEWORKS FOR RESEARCH

Oliga (1988) identified three methodological foundations of research, underpinned by Habermas' three paradigms. These are:

Methodology	Paradigm
Empiricism	Functionalism
Hermeneutics	Interpretive
Critique	Radical/ critical

Meredith et al (1989) highlighted that there are a number of dimensions on which research activity could be classified; these include how formal the research activity is and whether the research is artificially carried out in a laboratory setting or naturally carried out in a real situation. They grouped research methods under headings on this scale.

Direct Observation

Field Studies

Field Experiments

Action Research

Case Studies

People's Perceptions

Structured Interviewing

Surveying

Historical / archival analysis

Delphi

Unstructured interviewing

Expert panels

Futures research / scenarios

Introspective reflection

Artificial

Reason / logical deduction / theorem proving

Normative analytical modelling

Descriptive analytical modelling

Prototyping

Physical modelling

Laboratory experimentation

Mathematical simulation

Conceptual modelling

Hermeneutics

Meredith et al (1989) combined the dimensions of rational / existential and natural / artificial to build what they termed, a Generic Research Framework, shown below in figure 8.1.

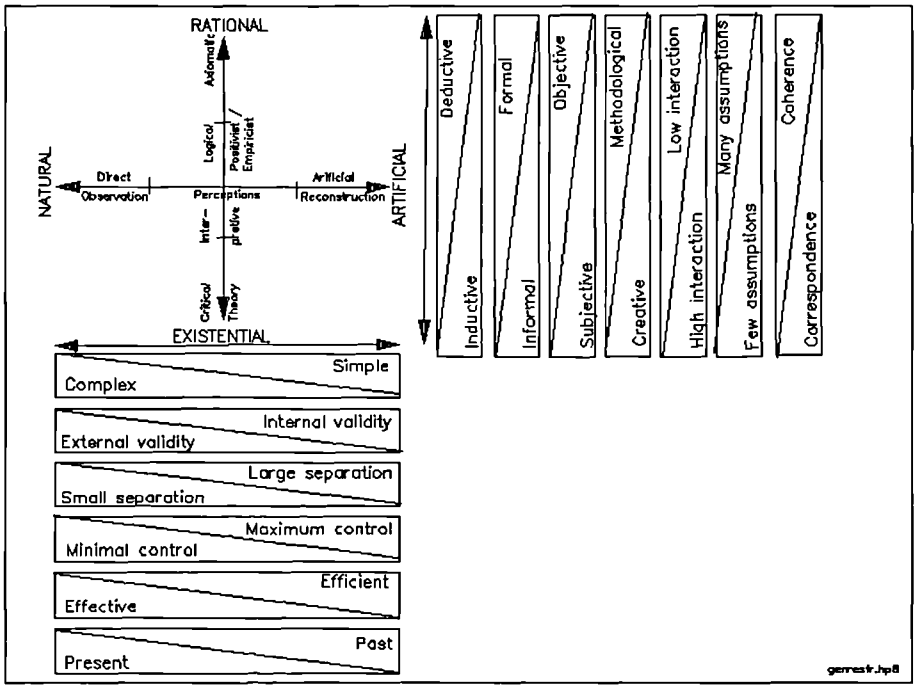

Figure 8.1: **Generic Research Framework** Source: Meredith et al (1989)

They provided a useful classification table which combined these dimensions of natural / artificial and rational / existential and located research methods

within this grid. This is reproduced here below in figure 8.2

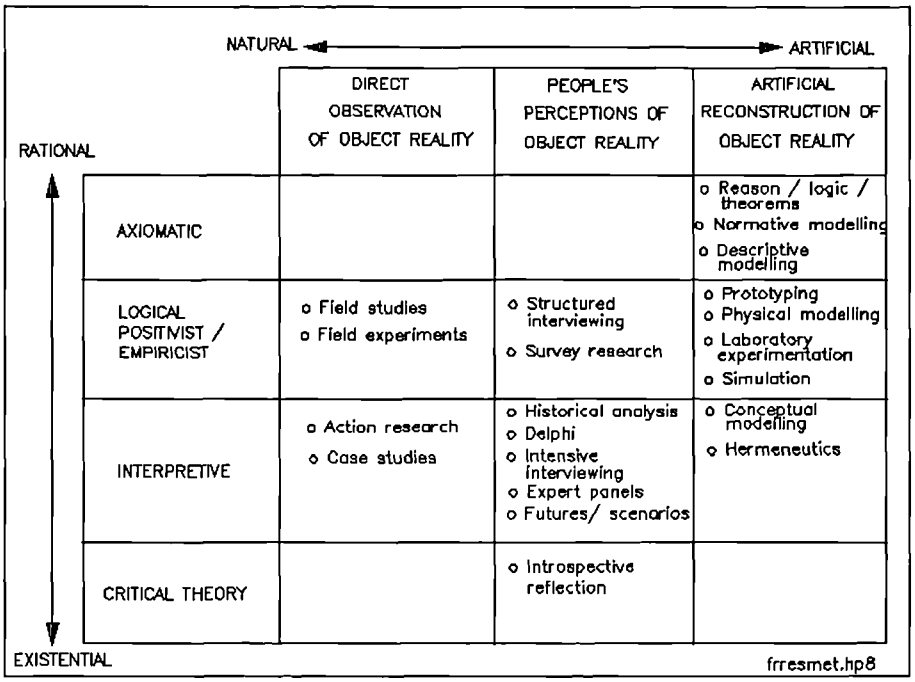

Figure 8.2: Location of research methods Source Meredith et al (1989)

It has already been identified that an empiricist methodology will be adopted for this research. The research hypotheses explicitly intend to investigate people's perceptions of object reality rather than perform direct observation or artificial reconstruction of object reality. From Meredith et al's table this points towards structure interviewing or survey research as appropriate methods to use.

Structured interviewing vs. survey research

There are important distinctions to be made between structured interviewing and survey research, as

highlighted by Brewer & Hunter (1989). These are further developed and summarised in the table below.

STRUCTURED INTERVIEWING	SURVEY
Focus on field setting	Focus on population
Biased sample of larger population	Unbiased sample of larger population
Variable structure to interview	Very highly structured
Questions asked can be explained, therefore some questions can be more complex	Little explanation is possible, therefore simple questions must be asked
Clarification of answer can be sought, sometimes involving documentation	Little scope for clarification of answer
Researcher often travels to the participant's location	Researcher rarely travels to the participant's location
Usually face-to-face	Usually mail or, for smaller samples, telephone

Table 8.1: Comparison of survey and interview methods

The nature of the subject area of supply chain management has been shown to be relatively new, not clearly understood and also conceptually complex. The research hypotheses for this particular piece of research are also unlikely to be the subject of common discussion in companies and, therefore, may involve questioning in territory which is unfamiliar to the participant. The discussion in chapter 5 on dimensions of performance also showed a variety of terms to describe performance which is a key focus of this research.

Therefore, it appears to be inappropriate to use the survey method of research and instead structured interviewing appears more appropriate. However the nature of the research indicates a semi-structured rather than a highly structured interview is more appropriate for the reasons given above.

CONCLUSIONS

It has been shown in this chapter that, whilst there appears to be disagreement on terminology, there is agreement that there are connections between and logical groupings of different orders of construct relating to research.

Whilst there is not agreement on the use of the term "approach", it has been used here to refer to the highest level of construct or generality and draws distinctions between discipline oriented stances such as science, social science or organisational study, qualitative or quantitative research, and rational / deductive or existential / inductive approaches.

The term "paradigm" has a clearer meaning in the literature and refers to the set of rules underpinning the researcher's position; these may be described as functionalist, interpretive and radical / critical; they reflect the objectivity and the intention to either describe or criticise. The methodological foundations

within these paradigms are empiricism, hermeneutics and critique.

Many different methods were listed and briefly described and, more usefully, grouped together to indicate more logical choices for particular types of research.

It was concluded that the nature of the hypotheses for this research tend to indicate the following selections:

CONSTRUCT	SELECTION
Approach	Social science, qualitative, rational
Paradigm	Functionalist
Methodology	Empiricism
Method	Semi-structured interview

Table 8.2: Selected research approach, paradigm, methodology and method

It is recognised that research does not have to adopt only one method of data collection (Brewer & Hunter (1989)) but this review of the research methodology literature has indicated which methods appears to be more suitable than others.

It is interesting to note here that Meredith et al (1989) indicated that only 1% of operations management journal articles surveyed in 1987 had researched people's perceptions of object reality using empirical work in the

form of questionnaires or surveys, as shown below in figure 8.3:

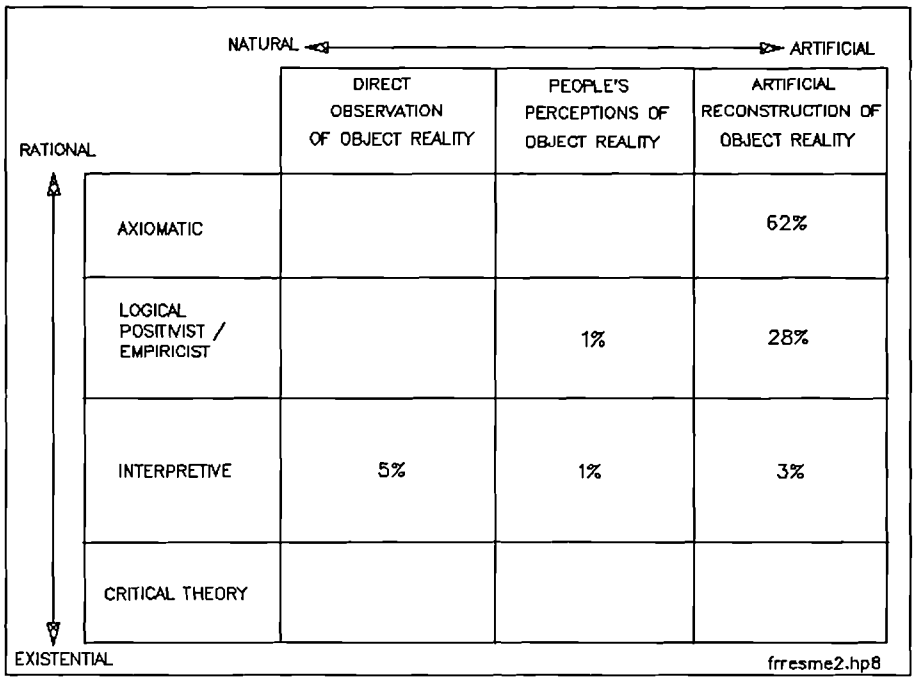

Figure 8.3: Distribution of journal articles on OM topics. Source Meredith et al (1989)

As can be seen in the above figure, 62% had published results of research by artificial reconstruction of object reality, primarily in the form of mathematical models and simulations. Chase (1980) identified that most operations management research had bee laboratory based using abstract assumptions and that little work had been done out in the field. Andrew & Johnsons (1982) highlighted that operations management researchers were reaping academic success using algorithmic modelling and found no need to look for alternative research paradigms. Buffa (1980) supported this by expressing the view that the methodologies of management science and operational research should not define the field of operations

management and that they do not provide a future direction for the subject.

Meredith et al (1989) summarised the criticisms of past research in Operations Management as follows:

1. Narrow instead of broad scope

- Focused on problems with a narrow scope (Buffa, 1980)
- Largely micro oriented (Chase, 1980)
- Concerning a sub-system, rather than a whole system (Buffa, 1980)
- Used single criterion quantitative models (Buffa, 1980)

2. Technique instead of knowledge orientation

- Dominated by the application of techniques (Chase, 1980)
- Assumed to be simply applied Operations Research (Voss, 1984)

3. An abstract instead of a real perspective

- Used approaches largely confined to the laboratory and based on model formulation and manipulation (Chase, 1980)

- Emphasised equipment rather than people (Chase, 1980)

- Rarely involved field studies (Chase, 1980)

- Even in the few studies using real-world settings, the research approaches were characterised by one-day visits, interviews and the use of questionnaires (Hill, 1987)

In the inaugural edition of the Journal of Operations Management, authors including Buffa (1980) and Chase (1980) were appealing for research that:

- looked at unstructured, real-world problems

- used more than one criteria for evaluating these problems

- looked at the whole system and considered relationships between sub-systems as well as within them

Therefore, the apparent lack of this type of research in operations management shows a need more research of

people's perceptions of or direct observation rather than artificial reconstruction of reality. Having identified appropriateness of different research approaches, paradigms, methodologies and methods, the next chapter uses this as guidance to design a specific research instrument for this piece of research.

CHAPTER 9 - DETAILED RESEARCH

SUMMARY

In chapter 7 the research hypotheses were developed. Chapter 8 considered research theory to identify the appropriateness of particular approaches, paradigms, methodologies and methods to this study; using this guidance the detailed research instrument is designed here.

Firstly the main stages in the research process are identified.

Next the research instrument and research sample are designed. To do this the problem context is considered. Also the variables not being tested in this research are identified and isolated. Then the research instrument for data collection is designed; dimensions of performance relevant to this research environment are determined. The research instrument itself is an adaptation of Carlisle & Parker's (1989) four-way perception assessment model, applied to the performance dimensions of quality, delivery, service, range and price during semi-structured interviews. The adapted model is called a **Mismatch Model.** The chosen sample comprises four supply chains - one braking products and one electrical products chain in the UK and the same in Spain. These chains are similar in structure and each include a manufacturer, an area distributor, a local distributor and ten representative installers.

The interviews are to be tape recorded, transcribed then the data is to be analysed qualitatively and quantitatively to investigate the hypotheses. The qualitative analysis is to identify gaps between customers' and suppliers' perceptions of performance and categorise them into four types of mismatch, then to make comparisons in this data. The quantitative analysis is to manage the cross variable comparative analysis of multiple groups of data and includes frequency analysis, Tukey tests, and correlation. To perform the quantitative analysis necessarily means that numbers must be applied to the data.

Chapters 10 and 11 will discuss the qualitative and quantitative analysis in more detail with chapter 12 discussing the results of both relative to the hypotheses.

INTRODUCTION

Chapter 7 developed and presented a set of research hypotheses for this piece of research. Chapter 8 reviewed available research approaches, paradigms, methodologies and methods. It was identified that the hypotheses did not demand any interpretation of, or self reflection on, requirements and performance in supply chains. They demanded observation in an objective fashion. It was concluded that the approach for the research should be more social science than science oriented, primarily qualitative and more rational than existential. The appropriate paradigm for the research was identified as a functionalist paradigm. The relevant methodology for that paradigm was shown to be empiricism and the most appropriate empirical method for the research was shown to be semi-structured interviews.

The main objective of the chapter is to design the research instrument for data collection and to design the sample; this must be performed in the context of the problem environment. A further objective is to design the appropriate analysis of the data. Firstly, though, it is useful to understand the process of research design.

THE RESEARCH DESIGN PROCESS

Generic models of the research design process have been provided in the literature. Bryman (1988a) identified the following stages as being present in research.

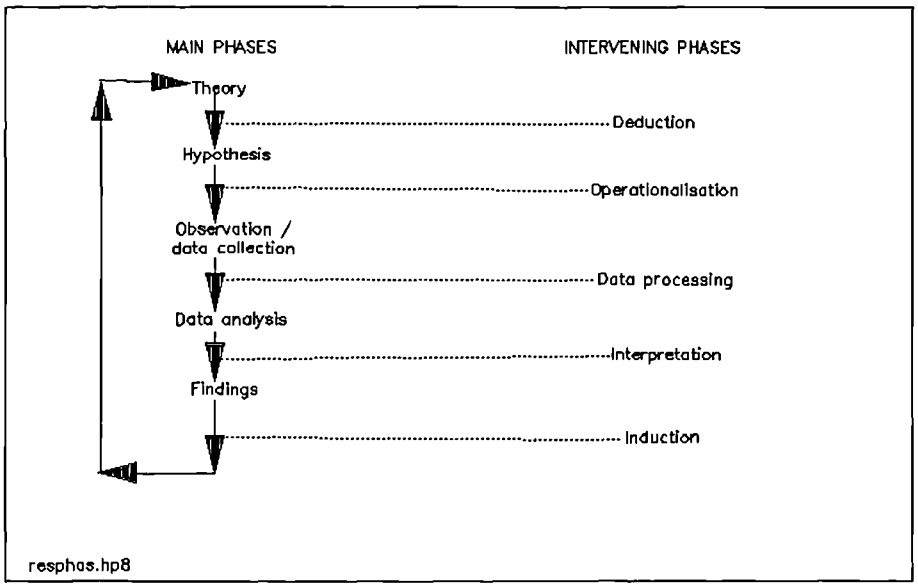

Figure 9.1: Stages in the research cycle Source Bryman (1988a)

Bryman highlighted that more qualitative research may not have formal, testable, hypotheses derived from theory but instead may pose research questions to be investigated. The observation / data collection and data analysis phases would be more subjective and less numerically based in non-quantitative research. The phases provided by Bryman offer a generally accepted model for more rational research and therefore could be applicable to this particular dissertation. (Other models of research design for research beyond this investigation are considered in chapter 13).

Prior to designing the research instrument, the problem context should be considered (Jackson and Keys 1984).

THE PROBLEM CONTEXT

This section briefly describes the supply networks within which the research was to be performed. These networks relate to one company, referred to here as **The Case Company**. This particular company was selected for pragmatic reasons of access through existing contacts. This pragmatic approach, governed by access, was identified in research theory of organisational studies, discussed in chapter 8. These contacts existed because of a personal history of SERC funded research with the Case Company and also a current research project funded through the EC ESPRIT initiative.[1]

The Case Company

The Case Company is an international limited company in the automotive aftermarket. Within the company are international, national and local distribution businesses and (at the time of the research) also a chain of installers (garages) at the retail level i.e. the company is primarily in distribution, not manufacturing. The Case Company is part of a larger group operating in the automotive, aerospace and applied technology markets.

It is a necessary part of research design to isolate relevant independent and dependent research variables.

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1 ESPRIT II Project No. 2277 - CMSO (CIM for Multi-Supplier Operations). Project partners - Actis (Germany), A.D.I.S.T. (Portugal), A.F.I.A. (Portugal), Alcatel (France), B.I.B.A.- University of Bremen (Germany), DAF (Netherlands), Helsinki University of Technology (Finland), Karmann (Germany), Lucas (UK), National Technical University of Athens (Greece), SAAB Valmet (Finland), Technical University of Delft (Netherlands), Vegla (Germany), Warwick Business School (UK).

Isolating independent and dependent research variables

The hypotheses for this research aim to isolate and investigate differences in customers' and suppliers' perceptions of requirements and performance in supply chains i.e. these are to be the dependent variables.

It was identified in the literature chapters that behaviour in relationships is affected by other variables, namely:

(i) the nature of the network context (see for example Hakansson et al 1990, Cunningham 1990, Ford et al 1986, Mattsson 1985, Stock & Lambert 1987, Achrol et al 1983, Turnbull & Valla 1986, Farmer & Ploos van Amstel 1991, Newman 1988, Easton & Quayle 1990 and Morgan 1987). Specifically within this the cultural differences associated with territory (see for example Achrol et al 1983, Hakansson 1982, Lamming 1989 and 1993, Gladwin & Walter 1980, Bartlett & Ghoshal 1992, Ohmae 1989 and Klassen & Whybark 1994)

(ii) product / process differences (see, for example, Christopher 1985, Lamming 1989, Curran & Stanworth 1983, Kotler 1984 and Barnes 1987)

(iii) number and type of echelons in supply chains (see, for example, Nishiguchi 1987 and 1994,

Barnes 1987, Forrester 1961, Towill 1982, 1991, and 1992, Edghill et al 1988, Burbidge 1961, 1984, Stalk & Hout 1990 and Coyle 1982)

None of these differences are to be investigated in this research; therefore, each of these should be isolated and tested to ensure that they are not influencing the results.

(i) Limiting the effect of the network context

To try to remove influence caused by the network context, it was decided to select supply chains from one company's total network. The Case Company's total network at the time of the research was very complex as it was a large, international company with manufacturing, area distribution, local distribution and installers in many countries of the world. The facilitators at the case company advised that two territories - Spain and UK - could be investigated.

Figures 9.2 and 9.3 below show network maps prepared with the Case Company of the UK and Spanish Networks[2]; these are general maps drawn to represent the market structure in each territory, rather than the Case Company's owned networks.

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2 Araujo (1990) identified that the network should be drawn primarily by the actors rather than the researcher, as they are in a better position to understand the richer picture of the relationships

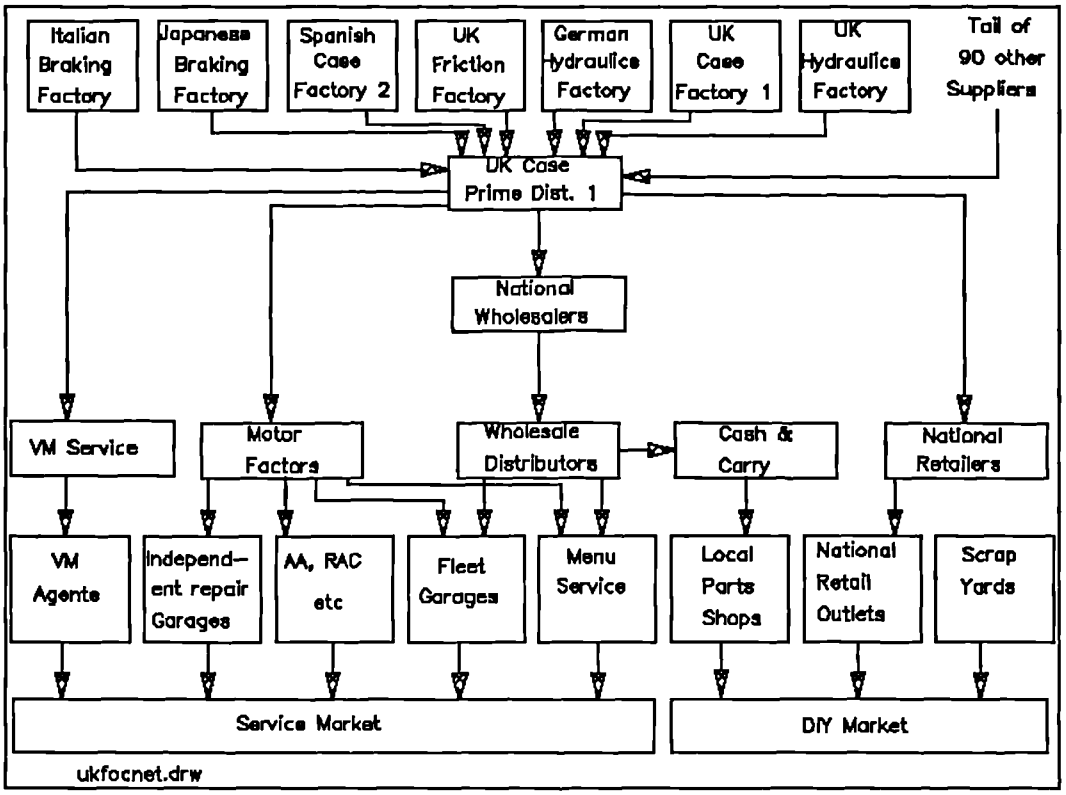

Figure 9.2: Case Company's UK Network

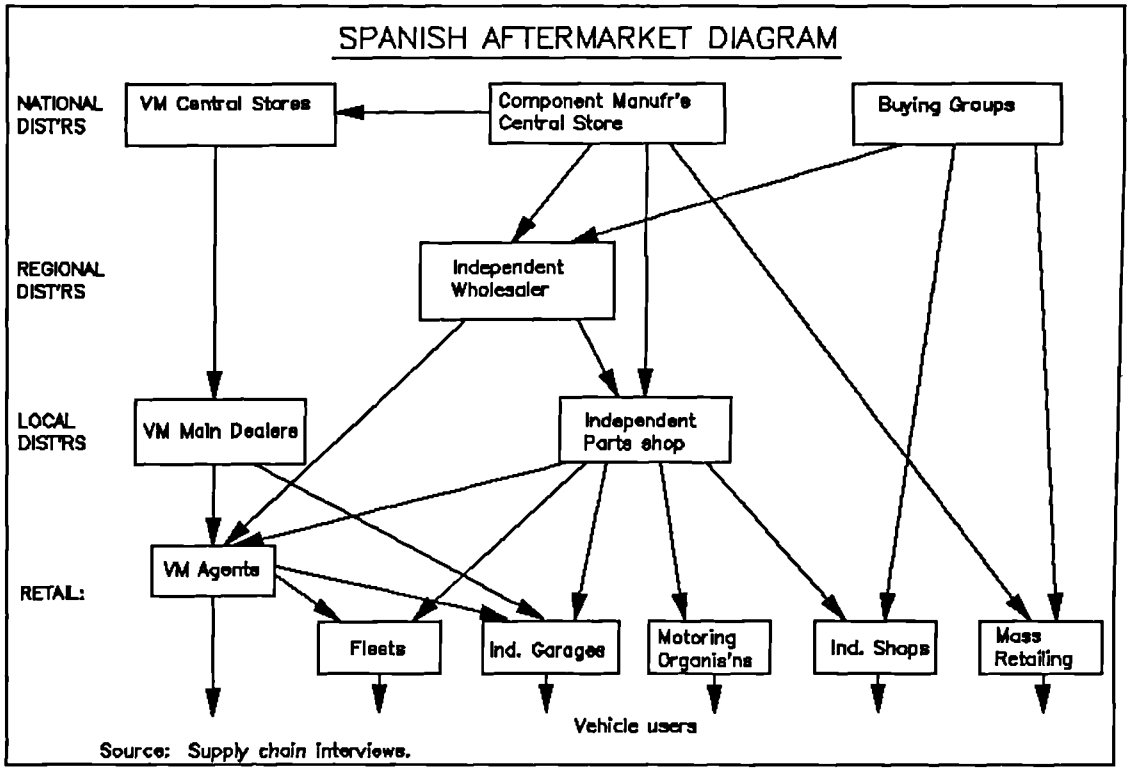

Figure 9.3: Case Company's Spanish Network

There are some observable differences in the structure of these two networks. For example, in Spain the presence of buying groups is a feature of the network which is quite significant whereas in the UK automotive aftermarket it is not. The UK aftermarket network contains a newer type of installer - a menu service installer - which, at the time of the research, was not present in Spain[3]. To limit the effect of the these differences in network structure, structurally similar chains were selected.

(ii) Limiting the effect of the product / process

Banathy (1987) identified that product differences should be considered in research design. The Case Company manufactured and supplied braking, electrical / electronic and diesel automotive components; the processes and technologies associated with these different product groups differed significantly. For example, the electrical products were changing rapidly as Original Equipment Manufacturers were increasingly controlling vehicle systems electronically. These newer electronic products were significantly more complex than the electrical parts they replaced. This placed very different demands on the supply chains providing service and repair parts in terms of technical support. In contrast, the braking and diesel products were relatively lower technology; managers of the Case Company felt that

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3 Menu service installers offer a limited range of fixed price service and repair options, such as clutch and brake repair; they were viewed by the Case Company as being present in relatively mature, more highly segmented markets.

there was greater understanding in the installers and the chains supplying them about the technical nature of these parts.

As well as differences in technical support processes associated with the different product groups, there were different administrative processes. For example, electrical starters and alternators exhibited a peculiarity in their supply chain in that old parts taken from vehicles were returned up the supply chain to be refurbished by a re-manufacturer and then sold again in their refurbished state. Administratively this created a different set of supply chain processes to control this reverse product flow. This also had a significant impact on the planning and control aspects further up the supply chain as the re-manufacturer had to predict returns of particular types of starter and alternator "cores".

Also related to product / process differences is the issue of whether the products considered are new products or existing products. It could be argued that new products may require different processes initially; for example training courses are provided to installers to deal with diagnosing faults with newer electronic components. Robinson et al (1967) defined three buy classes relating to whether products have been bought before or not; these are:-

- new buy
- modified rebuy

- straight rebuy

The research hypotheses did not require distinction to be made between the products and processes associated with new buys, modified rebuys or straight rebuys. However, to limit any possible influence through differences between these categories it was agreed to focus attention on rebuys as opposed to new buys.

As the difference between product types was not central to the research hypotheses, it was decided to investigate chains dealing with the rebuy of products from different product groups but to test for the effect of any product / process differences by way of validation. Discussions with several senior executives of the case company concluded that it would be useful to them for braking and electrical product chains to be compared.

It had been identified in the previous section that at least one chain in each territory was required. As two different product groups were to be investigated, therefore at least one chain of each product group should be investigated in each territory i.e. a minimum of 4 supply chains should be examined.

Having made choices relating to territories and product groups to be included in the study, choices had to be made in the research on how much of the Case Company's supply network would be included in terms of how many

levels or echelons would be investigated. The next section considers this issue.

(iii) Number of echelons in the supply chain

In the supply chain management research the holistic views taken by Womack et al (1990), Lamming (1993) and Harland (Jones) (1989, 1990a, 1990b, 1990c, 1993) and supported by Slack (1991) favour a complete systems view being taken. In the general operations management literature, prior research has been criticised for failing to take this system wide view (Buffa 1980).

In particular Christopher (1989 and 1992), Barnes (1987), Jones & Riley (1985) and Harland et al (1993) favour inclusion of the end customer in the research to gain an understanding of end customer requirements, the logic being that the last person to make a product / service differentiation decision in a supply chain injects the only real currency in the chain. The rest of the supply chain upstream merely passes on proportions of that end customer's money to other companies.

From discussions with the Case Company and exploratory interviews with installers it became apparent that few vehicle owners made a parts choice when having their vehicle serviced or repaired. The Case Company viewed the installers as making the last product differentiation decision in their supply chains; this view was supported by the installers and, by non-scientific research, by a

sample of consumers (car owners). Therefore, it was decided that the supply chains studied must go downstream to the installers and treat these as the end customer.

However, initial discussions with installers and with the Case Company managers identified that it would be difficult to choose one installer whose views could be seen as being representative of all installers buying particular products (braking or electrical) in a particular territory (UK or Spain). The network maps presented earlier in figures 9.2 and 9.3 showed different types of installers supplied by the Case Company supply chains; these included independent garages, menu-service operators (UK only), VM agents, fleet garages, motoring organisations, local parts shops and national retail outlets.

Unpublished market research performed by the Case Company had indicated that different types of installers had different priorities, therefore this indicated that a range of installers should be selected, roughly in proportion to the numbers of each type of installer in the market. A pragmatic approach was taken to choosing a sample size of ten installers at the end of each chain. This number was large enough to give a representative view and not so large as to deter co-operation of the local distributors (who would have to facilitate the contact with the installers). Regarding the choice of which installer types should make up the ten, it was

agreed that this had to be decided with the local distributors who supplied the installers; their views and co-operation to gain access to each of these installers had to be sought.

Having identified that the research would go downstream to the end customer, it was necessary to decide how far upstream to go. The Case Company operated businesses up to the point of area distribution. These area distributors bought components from manufacturers, some of whom were part of the Case Company's group organisation. Managers of the Case Company perceived significant problems with the relationships with manufacturers and therefore preferred the research to extend upstream to include the manufacturer, but no further as they were unable to secure access. Therefore, it was decided that the length of the supply chains investigated should span from manufacturer downstream through distributors to installers.

The choice of the number of supply chains in each territory and each product type could only be made once the nature of the research instrument was decided on (given the minimum of four chains already identified). The instrument would determine the depth of the research in each supply chain member and would affect the time and effort required to carry out the research. This would therefore influence the number of supply chains which

could be studied. The next section therefore discusses the research instrument.

THE INSTRUMENT

The research instrument has to be able to collect data on customers' and suppliers' perceptions of requirements and performance against different performance dimensions. The collected data must facilitate comparisons and allow relations between variables to be identified.

In this section choices are made on (i) the dimensions of performance to be examined (ii) the tool to measure the gap between customers' and suppliers' perceptions of requirements and performance (iii) the specific research method to collect the data.

Choice of performance dimensions to be examined

The discussion in chapter 6 on performance identified different sets of performance dimensions ranging from a small set of hard, rational, variables from the early work in purchasing (Smith et al 1963, Stevens 1978, Wieters 1976) and the work in manufacturing strategy (Skinner 1969, Wheelwright 1978, Miller 1983, Hayes & Wheelwright 1984 and Slack 1991) to larger sets of softer, more service oriented variables from the work in service operations management (Parasuraman et al 1985, Fitzgerald et al 1991 and Johnston & Silvestro 1990).

It is a stated intention of this research to take a customer service oriented view of supply chain management. However, the problem context is the distribution environment which is quite hard in terms of the relative importance of the product in the product / service package.

The literature has provided a variety of spectra and classifications of operations situations which highlight key differences between hard manufacturing and softer service environments. For example, Wild (1979) categorised operations into manufacture, transport, supply and service, with the primary considerations, shown below in table 9.1.

Principal function	Primary consideration
Manufacture	Goods
Transport	Movement
Supply	Goods
Service	Treatment

Table 9.1: Principal customer wants in types of operations (adapted from Wild (1979)

In Wild's categorisation, distribution is a form of supply operation where the state of the materials remains largely unaltered by the process of supply. Customers are more focused on the goods, as in manufacturing, than they are on the treatment, as in service. This implies that the characteristics of a distribution environment may share more similarities with manufacturing than service.

Meredith (1992) distinguished between products and services by the dimensions of tangibility, customer contact, customer participation in the delivery, time of consumption, labour & equipment intensity and ease of measuring quality. Against these dimensions distribution appears to be closer to product oriented environments than to service but would not be at the polar extreme. For example, as far as tangibility is concerned, there are important intangible aspects of the service side of some distribution businesses associated with sales order processing and technical support processes. These ideas have been combined to form a spectrum, shown below in figure 9.4, on which it is proposed that distribution lies off centre, closer to manufacturing than to service.

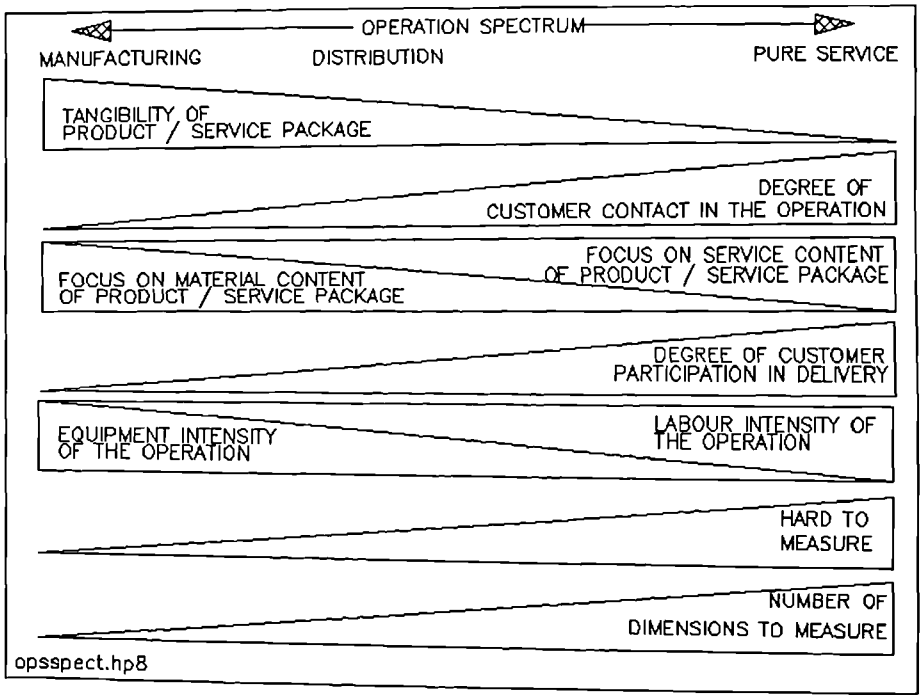

Figure 9.4: Spectrum of operations locating distribution

Whilst the distribution environment is largely concerned with the supply of goods, and could therefore be judged by the hard variables of quality, delivery and price, there are also important service oriented aspects to be considered, identified particularly by Womack et al (1990). The dimension headings of **quality, delivery, service, price and range** were selected to take into account some of these service oriented features of performance. Rather than attempt a generic definition and decomposition of each dimension, it is more appropriate to define these in the context of each relationship studied.

The next part of research design had to consider the nature of the tool to make comparisons between perceptions of requirements and performance against each of these dimensions, Therefore appropriate gap models will be considered here.

(ii) Tool to measure the gap between customers' and suppliers' perceptions of requirements and performance

Chapter 6 reviewed available models of performance measurement of which most did not consider perceptions of requirements and performance. These included the traditional models (notably the purchasing models provided by, for example, Lee & Dobler 1977, Stevens 1978, Ellis 1971, Karel 1979, Dempsey 1978, Gensch 1984, Baily 1979, Roberts 1978 and Cooper 1977) and the more

recent relationship models (see for example Ferguson et al 1989, Cousins 1992 and Brown & Cousins 1992).

It was identified in chapter 6 that the most widely accepted model of measurement of softer aspects of performance including perceptions was provided by Parasuraman et al (1985 and 1988) and is reproduced below in figure 9.5:

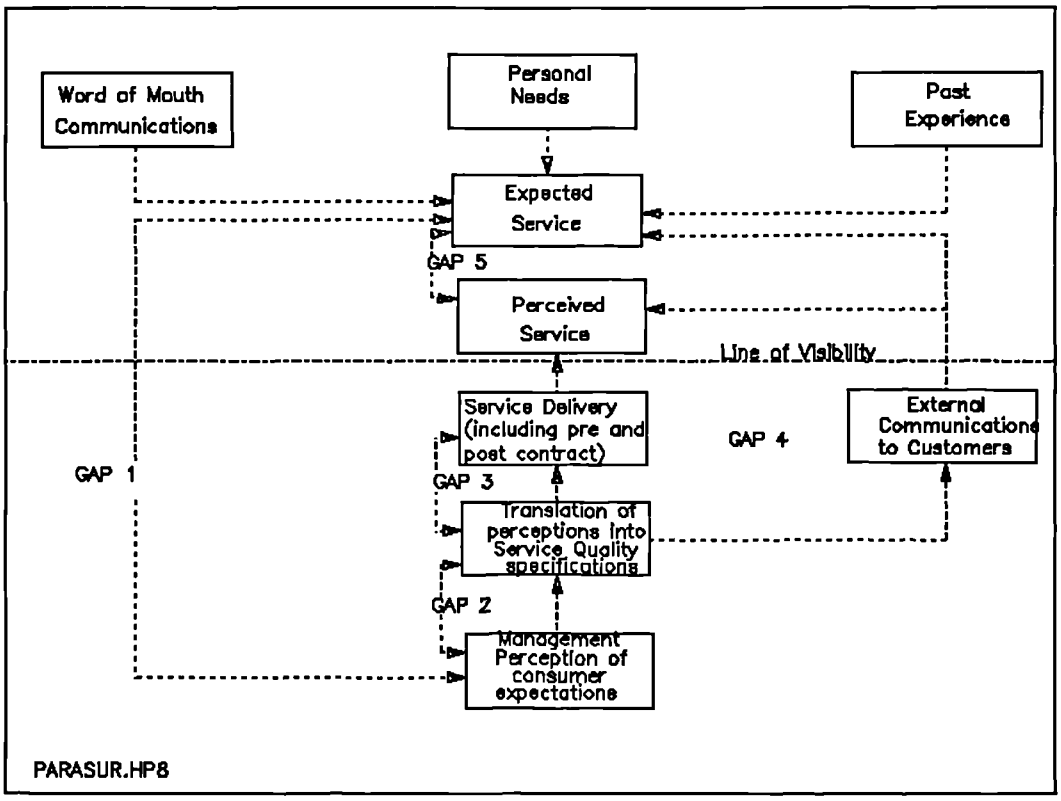

Figure 9.5: Parasuraman et al's (1988) gap model for measuring performance of service quality

Of the gaps identified in their model, it would appear that the following gaps are directly applicable to this research:

Gap 1: The gap between the management perception of consumer expectations and the consumer's expectations

Gap 5: The gap between the consumer's expectation of service and their perception of the service they receive

However, there are problems with attempting to use the Parasuraman et al model for this particular piece of research.

Firstly, the other gaps are not directly applicable - they require:

- analysis of the processes within the supplying business to isolate gaps between the perception of consumer requirements and the translation of those requirements into a specification (Gap 2)

- analysis of the processes within the supplying company to isolate gaps between their specification and their service delivery (Gap 3)

- analysis of the supplying company's processes to isolate the gap between their service delivery and what they communicate to their customers (Gap 4)

None of these requirements relate to the hypotheses for this particular piece of research.

Secondly, the Parasuraman et al model, being designed to deal with services to consumers, does not treat the customer as an equal party to the exchange relationship and does not involve as much investigation of the customer; this appears to be a weakness if the model is to be used upstream in the supply chain.

Thirdly, the tool to investigate the gaps - SERVQUAL - is a questionnaire designed around Parasuraman et al's comprehensive list of service oriented, intangible factors and is therefore inappropriate for this environment.

A simpler model was described in chapter 6, provided by Carlisle and Parker (1989) which assumed equal rank to both parties in the relationship and compared perceptions of each parties "actions". This is shown below in figure 9.6:

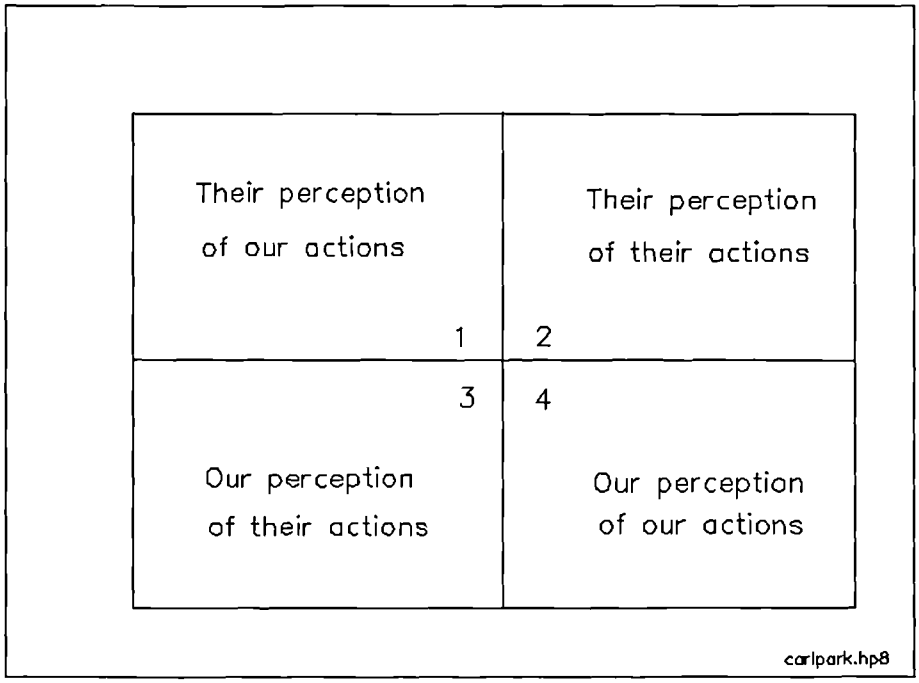

Figure 9.6: Carlisle and Parker's 4 way perception assessment

The hypotheses for this research require understanding of both parties perceptions' of customer requirements and of supplier performance i.e. an understanding of **outputs.** Carlisle and Parker's model offers an understanding of **process.** A simple adaptation to the Carlisle and Parker model enables the required comparison of outputs for this research. This adapted instrument is shown below in figure 9.7:

As is identified in the figure below, differences in these perceptions are termed **Mismatches;** assessment of four different mismatches are required for this research.

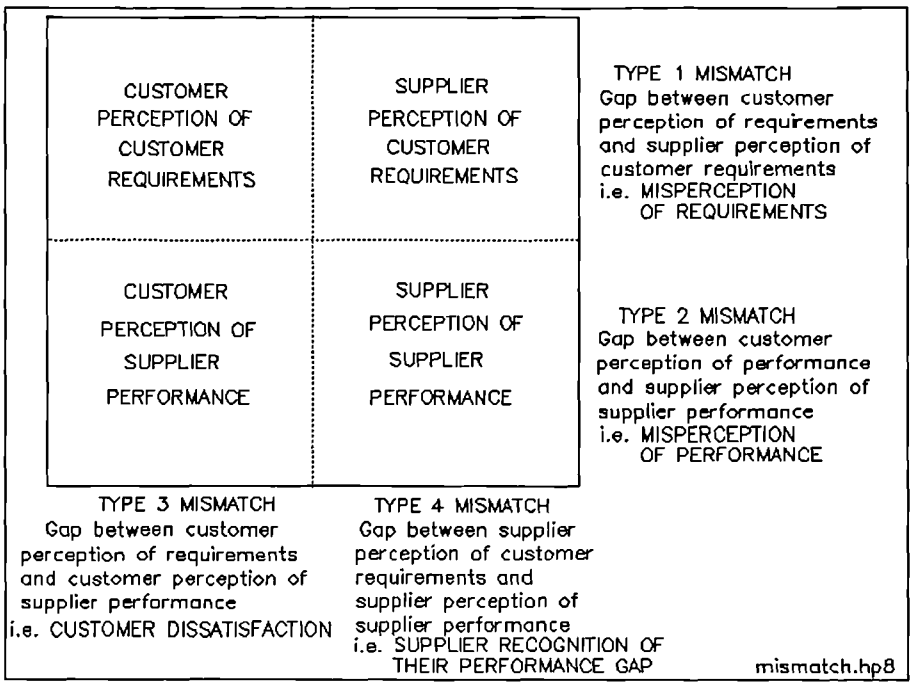

Figure 9.8: Research instrument for investigating customer and supplier perceptions of requirements and performance - The Mismatch Model

A **Type One Mismatch** represents the gap between what the customer in the relationship claims to require and what the supplier in the relationship perceives the customer to require. A mismatch here highlights some possible misunderstanding between the parties about what is required.

A **Type Two Mismatch** highlights the difference between the customer's perception of the supplier's performance in satisfying them and the supplier's perception of their own performance. A mismatch here may highlight difference of opinion about how well the supplier is performing; this may be due to a real difference or, in some cases,

to different measurements being used by each party to the relationship, or to unfounded differences in opinion.

A **Type Three Mismatch** indicates the extent of customer dissatisfaction by showing the gap between what they require and what they think they get in terms of performance from the supplier.

A **Type Four Mismatch** represents the gap between what the supplier thinks is required and what the supplier thinks his performance is. Any mismatch here shows what the supplier may be focusing on to, in his eyes, improve his performance in the relationship. If there is no mismatch, the supplier may not perceive any urgency to improve his performance.

Other comparisons are possible using this tool; diagonal comparison of (i) customers' perceptions of requirements compared to suppliers' perceptions of performance and (ii) suppliers' perceptions of requirements compared to customers' perceptions of performance could be performed. However, these comparisons would not contribute towards the research hypotheses and would also not be useful without further investigation.

The dyad perceptions of requirements and performance against the performance criteria identified earlier of **Quality, Delivery, Service, Range** and **Price** are to be investigated for each of the supply chains studied.

Having designed the performance dimensions to be used and the tool to measure gaps, the next section considers the specific means of data collection.

(iii) Research Method - Data Collection

It was identified in chapter 8 that the most appropriate method of research for this piece of work would be semi-structured interviews.

The choice of interviewee in each company was made with the assistance of the facilitating company. The initial facilitating company was the Case Company - they facilitated contact with other independent companies who in turn took on the role of facilitator to provide access to the next links in the supply chain. In the installers only the proprietor was interviewed; these companies employed an average of 5.5 people, including the proprietor. The other employees were usually mechanics.

In the larger businesses, interviews were carried out with, as far as possible, at least one board representative or senior executive and other managers and employees involved in dealing with customers and suppliers.

At the customer end of the business, Lambert et al (1990) point out that managers, customer facing staff and sales people are valid sources of information in addition to

customers, therefore interviews were sought with relevant personnel from these areas. This is an imperfect approach; different people face customers in different exchanges. Zeithaml, Parasuraman and Berry (1990) imply that "customer contact staff" can be distinguished in an organisation from "managers" but managers do not always take a back seat in the process.

At the supplier end of each company, it was necessary to identify those involved in dealing with suppliers. Robinson et al (1967) used the phrase "buying centre". Webster and Wind (1972) defined different roles in the buying centre of "users", "influencers", "deciders", "gatekeepers" (who control flow of information to others in the buying centre) and "buyers"; they argued that you need to identify who has what role and the criteria each are using in the purchasing decision. Studies on determination of buying centre composition and influence include Jackson, Keith and Burdick (1984), Kohli (1989), Kohli and Zaltman (1988) and Mattson (1988). In these studies it was apparent that selection of interviewee by job title and position in the management hierarchy would not necessarily guarantee that the relevant people were interviewed. Therefore, a pragmatic, company specific approach was taken to interviewee selection.

The Mismatch Model shown earlier in Figure 9.8 was used as a template during interviews. A different template for each performance factor of quality, delivery, service,

price and range was used. Interviewees at the customer end of the dyad were asked general questions about what they required from their suppliers in terms of performance. Their responses were inserted into the relevant templates by the interviewer. These responses used the phrases provided by the interviewee where their words provided a good illustration of their expressed opinions. The templates therefore contained some verbatim quotes as well as summary information collated by the interviewer. Where the interviewee had not expressed any opinion about a particular dimension of performance, they were prompted to do so, being asked specifically what their requirements were for that dimension.

Half of the interviews were carried out in Spain, usually in the first language of the interviewee. Some of the these were English people, but where the interview was conducted in Spanish, an interpreter was used to pose questions asked by the interviewer and interpret responses. The interpreter worked for the Case Company and was involved with the research, so therefore was aware of the correct terminology to use and the meaning of the responses. As in the English interviews, the richness of phrases provided were included verbatim to illustrate the opinions expressed.

Interviews lasted, on average, at least an hour, but the Spanish interviews tended to last longer because of the interpretation. All the interviews were taped and later

transcribed verbatim. The taped interviews were used to check and improve the recorded responses in the templates. These templates with responses formed the core of the data for the analysis. An example is provided in Appendix 2 and a further example, showing how scoring was allocated, is provided later in Chapter 11 which describes the quantitative analysis of the data.

Choice of Supply Chains

The nature of the research instrument and the volume of work this implied indicated it was only possible to investigate the minimum number of supply chains indicated as required by the methodology i.e. one braking and one electrical chain in each of the UK and Spanish territories. Whilst not studying a statistically large sample from which broad generalisations can be made, a smaller study can at least provide some illuminative information which may help further larger scale studies (Bell 1987).

The Case Company facilitated access to the four supply chains shown in figure 9.9 below.

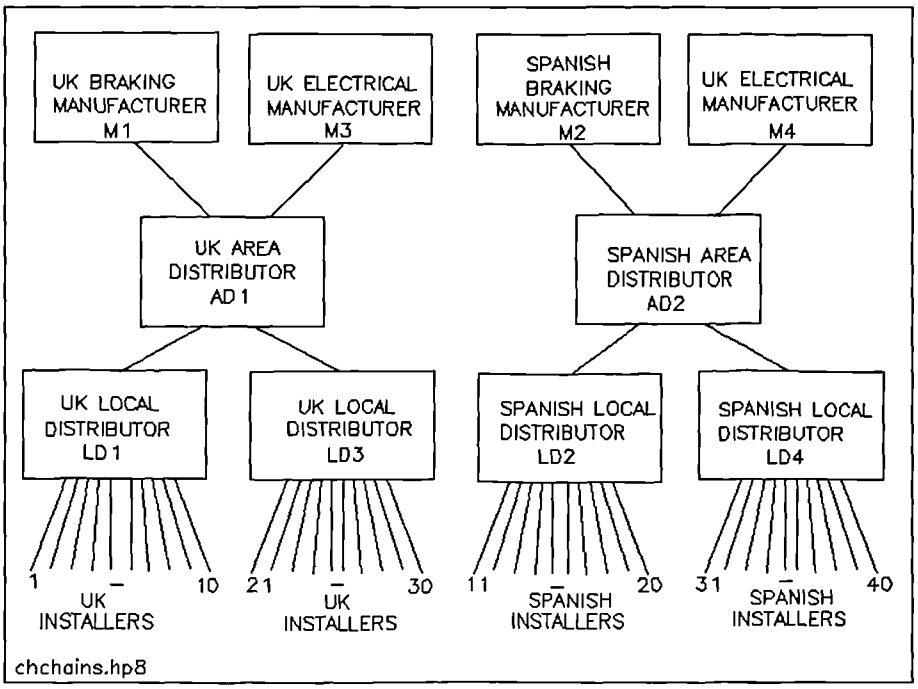

Figure 9.9: Choice of supply chains for this research

Having designed the research instrument and the interview sample, the next section describes the method of data analysis.

ANALYSIS OF THE DATA

It was identified in chapter 8 on research theory that the approach for the work should be primarily qualitative, but that this would not exclude quantification of the data.

Qualitative Analysis of the Data

Firstly it would be necessary to qualitatively assess the gaps in the mismatch tables. By comparing the comments made on both parties' perceptions of performance and requirements, a judgement on the extent of the gap could

be made. This is necessarily subjective, so was validated by another person; this validation is described later.

The gaps could then be compared across the supply chains to satisfy the research hypotheses.

However, a tremendous opportunity would be provided by assigning numbers to the data to allow cross variable analysis and correlation; this would be appropriate analysis particularly to test hypothesis 2.

Quantitative Analysis

To quantify the data would require some form of scale to be used. The most common form of attitudinal scaling in social science research is the Likert scale (Likert (1932)). Likert originally provided a 5 point scale to quantify attitudes. Since then various research has used 5, 7 or 9 point Likert scales. However, criticism of odd numbered scales was ventured by Lundstrom & Lamont (1976) who identified that the mid-point value allowed respondents to sit on the fence. Instead, they chose a 6 point semantic differential scale to measure consumer discontent from strong agreement to strong disagreement with no mid, neutral point. Therefore a 6 point scale is recommended here.

The specific scale to be used is a semantic differential scale assigning numbers to the extent of mismatch of

views ranging from harmony to polarity, as shown below in table 9.2:

0	Harmony of views
1	Slight difference in views
2	Moderate difference in views
3	Substantial difference in views
4	Very substantial difference in views
5	Polarity of views

Table 9.2: Likert scale used for scoring mismatches

To investigate the research hypotheses, the analysis stages shown below in figure 9.10 are proposed and justified here.

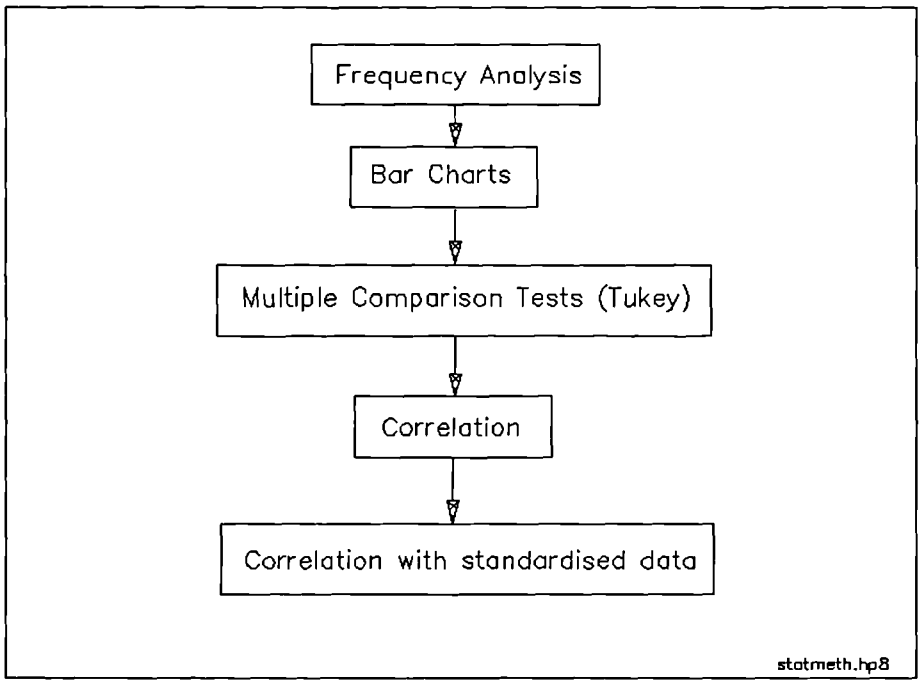

Figure 9.10: Flow Chart Showing Sequence of Analysis of Quantified Results

Each of these steps will be briefly discussed.

(i) Hypothesis 1 requires an indication of level of the variables studied. Therefore, the scores could be analysed using frequency analysis.

(ii) Comparison between 2 or more variables required by hypotheses 1 and 3 would be visually possible using bar charts.

(iii) As a visual comparison is not statistically safe, statistical tests on the differences between variables would identify if those differences were statistically significant. Student's t-tests were inapplicable as they should only be used for comparison of 2 groups of data. Multi-variable comparisons can be performed by F tests. The Tukey HSD (Honestly Significantly Different) test is a rigourous type of F test (Haber & Runyon (1973) which will be used here.

(iv) Hypothesis 2 requires correlation between data sets. As the data was not in the form of rankings, Pearson's r correlation is recommended.

(v) The data used in the correlation should be standardised to remove any effects of significant differences between values of variables not being tested. This identifies if

an underlying correlation still exists. To do this the scores requiring standardisation are converted to z scores.

The quantitative analysis would be performed on scores subjectively assigned. To ensure that these scores are not unduly biased they should be validated by another person.

Method of Validation of the scores

Firstly, the nature of the validation task would require some conceptual understanding of the performance dimensions, the process of comparison of perceptions of requirements and performance and the concept of a supply chain.

Secondly, the task would require someone with some experience of interpreting interview data, rather than someone from a completely unrelated field.

Thirdly, the validation should be performed on a substantial amount of the data to allow statistical comparison of scores.

CONCLUSIONS

Steps should be taken to isolate (i) the effect of the network context, including the effect of the territory (ii) differences between products and processes (iii) structural differences in the chains relating to the

number and type of levels. To do this (i) supply chains should be chosen from one case company's total network (ii) in different territories to allow comparison (iii) involving different product groups to allow comparisons (iii) associated with rebuys rather than new buys (iv) containing the same number of players in similar roles.

Therefore, 4 supply chains were selected for the research:

(i) UK braking products chain

(ii) Spanish braking products chain

(iii) UK electrical products chain

(iv) Spanish electrical products chain

The research instrument should be capable of investigating customers' and suppliers' perceptions of requirements and performance against appropriate performance dimensions. It was concluded that an adaptation of Carlisle and Parker's (1989) four way perception assessment model should be used.

It was also concluded that the research environment i.e. the distribution end of the automotive aftermarket, lay closer to manufacturing and pure service on a spectrum. Whilst being primarily focused on goods, it still shared

some characteristics with service focused operations and therefore the dimensions of performance on which to judge that environment should be closer to the harder, rational dimensions associated with manufacturing but should necessarily include some service dimensions. Therefore the main categories of quality, delivery, service, range and price were selected for performance dimensions; it was decided that a general sub-categorisation of these dimensions was not appropriate but rather this should be performed in the context of each individual relationship studied.

Research theory, reviewed in chapter 8, had indicated that some form of structured or semi-structured interview would be the appropriate research method. It was concluded that, whilst only the proprietor should be interviewed in the small installers, several relevant personnel related to customers and suppliers should be interviewed in the larger companies as the exchange involvement would be spread between many jobs.

It was concluded that the primary analysis for this research would be qualitative, in accordance with the guidance from chapter 8. However, a good opportunity would exist to extend perform cross variable analysis if the data were quantified, therefore it is concluded that this should be done using a semantic differential Likert 6 point scale. This would be necessarily subjective so should be validated by another person.

This chapter provided the means of generating the textual mismatch tables which form the core of the qualitative analysis in chapter 10. It also provided the means of generating the validated Likert scores table which forms the core of the quantitative analysis in chapter 11.

SUPPLY CHAIN MANAGEMENT:

PERCEPTIONS OF

REQUIREMENTS AND PERFORMANCE

IN EUROPEAN AUTOMOTIVE AFTERMARKET

SUPPLY CHAINS

Volume 2 of 2

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CHAPTER 10 - QUALITATIVE ANALYSIS

SUMMARY

This chapter considers and compares the textual comments made in the semi-structured interviews in the four supply chains studied. It performs the analysis in different steps at different levels of aggregation, namely:
(i) Analysis within the dyads, across the performance dimensions of quality, delivery, service, range and price and across the four types of mismatch of perceptions of requirements and performance
(ii) Comparisons between the dyads
(iii) Comparisons between the performance dimensions across all the dyads
(iv) Comparisons between the types of mismatch across all the dyads
(v) Comparisons between the chains
(vi) Comparisons between the chains in different territories
(vii) Comparisons between the chains involving different product types
(viii) Comparisons between the dyadic levels of installer / local distributor, local distributor / area distributor and area distributor / manufacturer

It is concluded that some, though little, difference appeared to exist between the chains, the territories and the product types, though this should be further checked using quantitative methods. There were substantial differences in customer dissatisfaction between the performance dimensions; customers appeared very dissatisfied with delivery performance but apparently satisfied with price. There was less clarity regarding differences in perceptions of requirements and performance across the performance dimensions.

When comparing types of mismatches, it appeared that there was substantially more confusion in the relationships about performance than about requirements. Also it appeared that customers perceived a far greater gap in performance than did suppliers.

Comparing the dyads, one particular relationship emerges as an outstanding example of harmony and clear understanding in the INS/LD dyad in the Spanish braking chain. Other poor examples are all further upstream in different chains at the AD/M level.

Upstream dyads were more dissatisfied than downstream dyads. Also, they exhibited greater misperception of requirements and performance than did the downstream relationships. This is to be tested for significance in the next chapter as part of the quantitative analysis.

INTRODUCTION

This research investigated customers' and suppliers' perceptions of requirements and performance in four supply chains:

(i) UK Braking Products Chain
(ii) Spanish Braking Products Chain
(iii) UK Electrical Products Chain
(iv) Spanish Electrical Products Chain

Each of the supply chains were similar in structure and included a manufacturer, an area distributor, a local distributor and 10 installers.

The customers' and suppliers' perceptions were grouped under the performance dimensions of quality, delivery, service, range and price. The differences in perceptions of customer requirements (Type 1, or T1, mismatch) and differences in perceptions of supplier performance (Type 2, or T2, mismatch) were recorded; these 2 types of mismatch were termed **misperceptions.** Gaps between customers' requirements and their perceptions of performance (Type 3, or T3, mismatch) were noted; these were termed **customer dissatisfaction.** Gaps between suppliers' perceptions of customer requirements and their own performance (Type 4, or T4 mismatch) were termed **supplier recognition of performance gaps.** These mismatch types are depicted in the model below in figure 10.1:

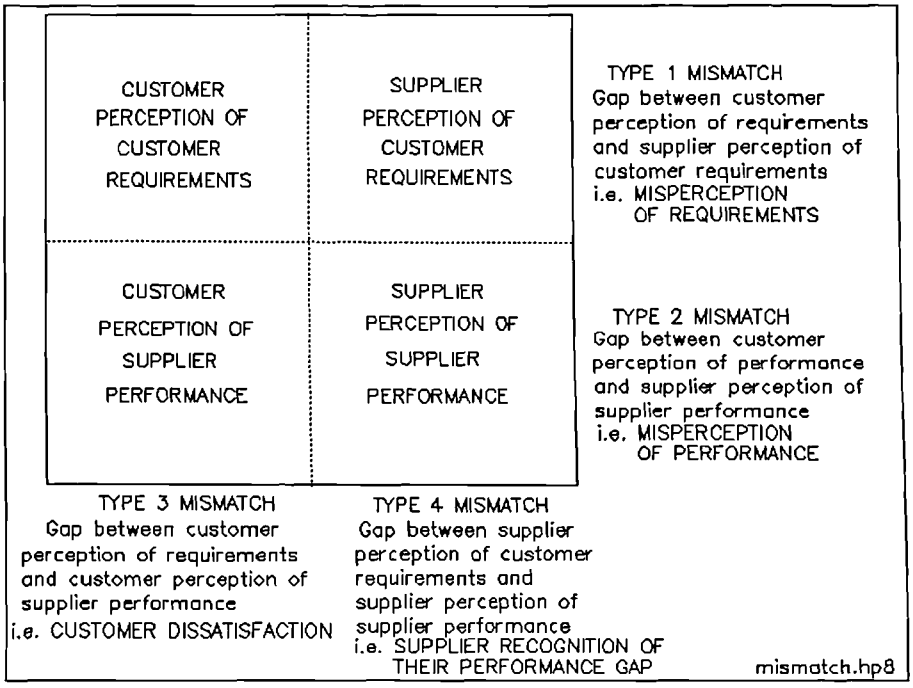

Figure 10.1: Mismatch model used in the research

These gaps between perceptions of requirements and performance will now be considered for each of the four supply chains studied using the following sequence of qualitative analysis.

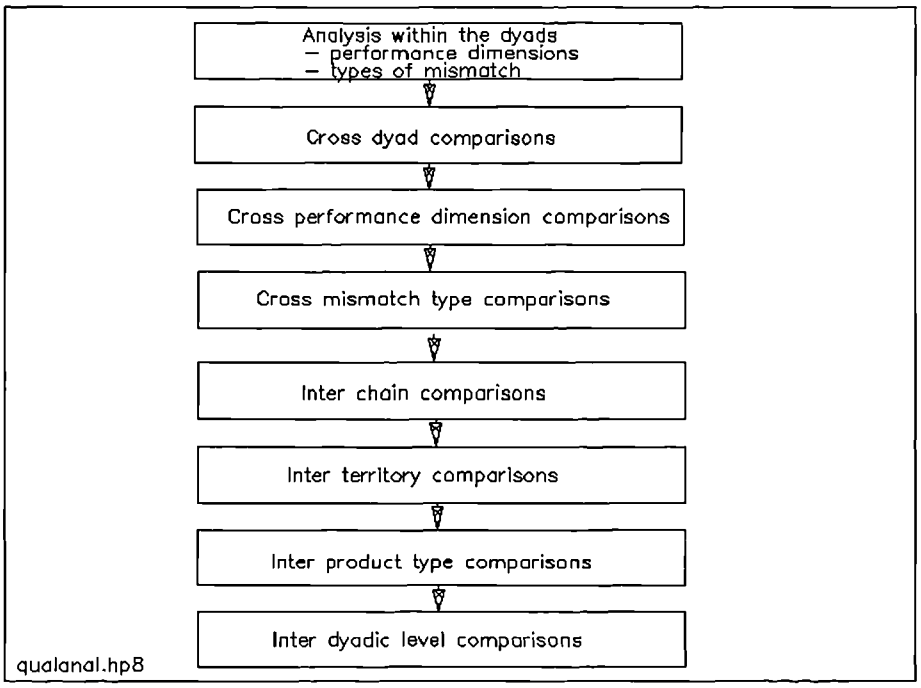

Figure 10.2: Sequence of qualitative analysis undertaken

Each of these steps in the qualitative analysis will now be explained and discussed. More explanation and discussion will be provided for the first supply chain to give more insight into the method of qualitative analysis undertaken than for the other three chains.

Firstly, qualitative results for each supply chain are considered for the first two steps i.e.

(i) the analysis **within** the dyads in each chain of the types of mismatch for each performance dimension will be performed

(ii) comparisons **between** the dyads in each chain of the types of mismatch across all performance dimensions will be performed

These two steps of qualitative analysis are depicted below in figure 10.3. The four supply chains studied are as shown below in figure 10.4.

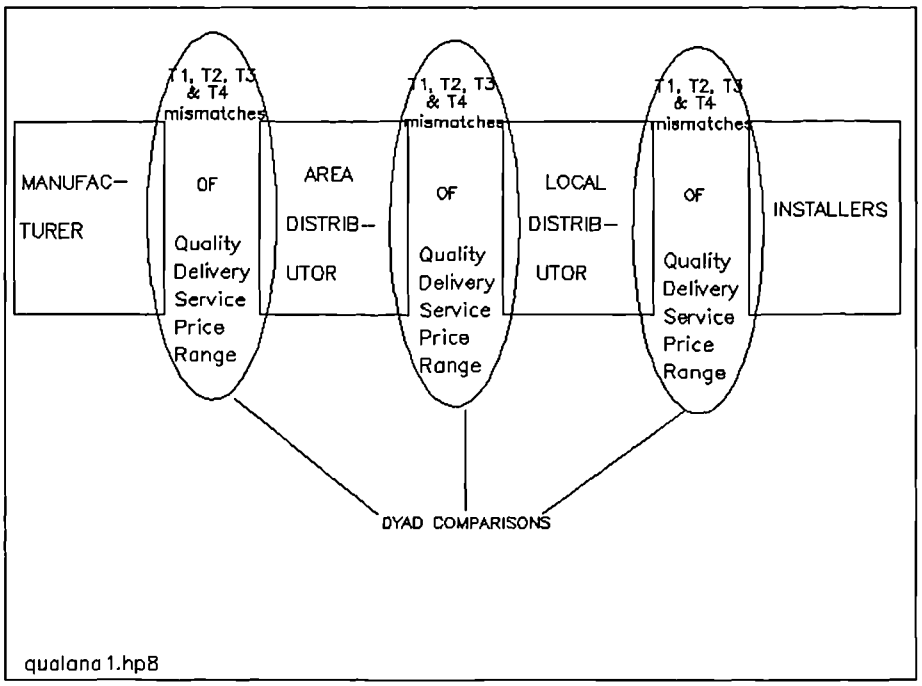

Figure 10.3: Depiction of the analysis of performance dimensions and type of mismatch within each chain

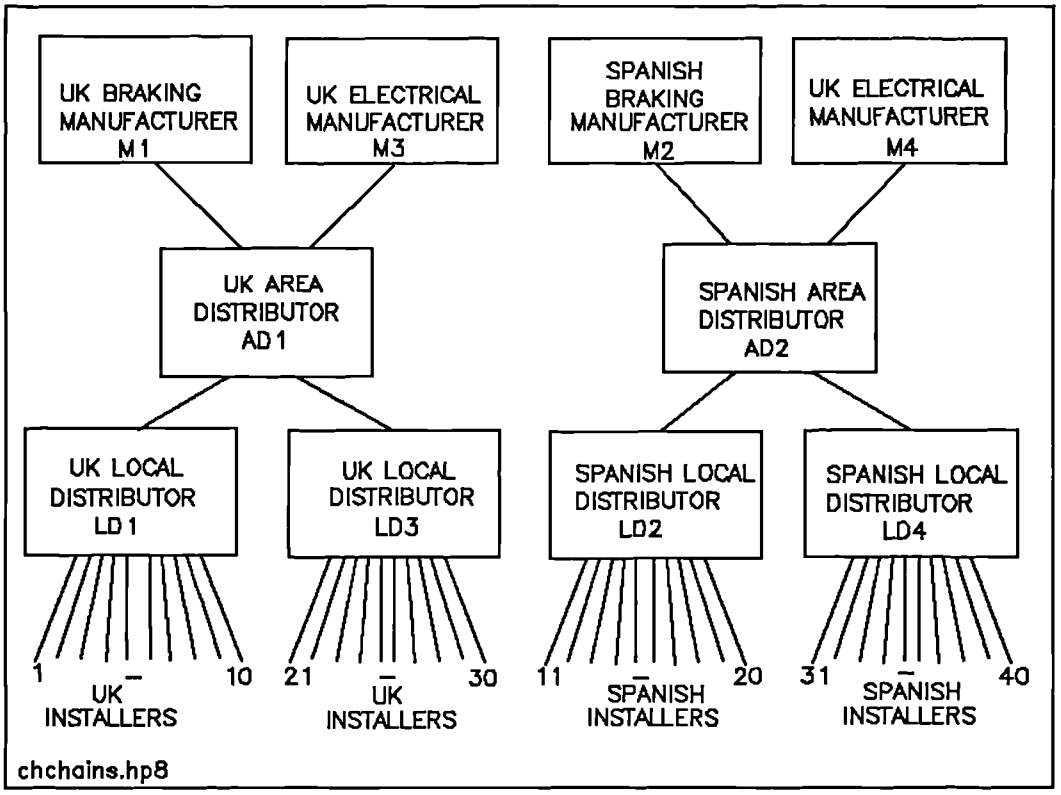

Figure 10.4: Four supply chains studied in this research

Prior to the analysis a brief description of each chain studied is provided, starting with the UK Braking Products chain.

ANALYSIS WITHIN THE CHAINS

UK BRAKING CHAIN

The qualitative analysis relating to this chain will be described more fully than the other three chains, particularly in the first section on the dimension of quality, to provide greater understanding of the derivation of the different types of mismatch and of their subsequent interpretation.

Firstly a brief description of the chain is provided.

Brief Description of the UK Braking Chain

The UK braking chain chosen was a route for hydraulic braking products, such as brake cylinders, from a UK manufacturer in Wales, through a UK area distributor in Central England, to a UK local distributor in Southern England, then to set of ten UK installers based around the local distributor in Southern England. The chain is represented in the figure below:

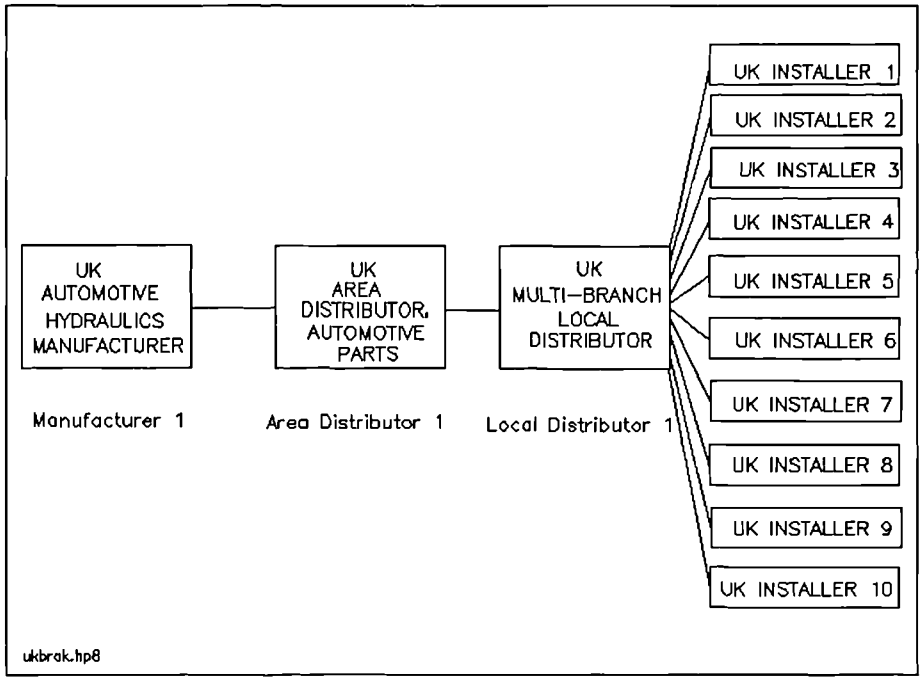

Figure 10.6: UK Braking Chain

Summary profiles of the companies involved in this chain and identification of the interviewees positions are provided in Appendix 1.

The next section considers the results of the qualitative analysis considering the performance dimensions of quality, delivery, service, range and price.

Performance dimension Comparisons

In this section each performance dimension is considered in turn. Observations are made about customers' and suppliers' perceptions of requirements and performance against each dimension. These observations were made by analysis of the mismatch tables described in the previous chapter, an example of which is provided in Appendix 2.

The first performance dimension to be considered here is **quality.**

Quality

Gaps in perceptions of requirements and performance for quality are considered here for each dyadic relationship in turn starting with the installer / local distributor (INS/LD) dyad.

The INS/LD Dyad At the installer end of this supply chain, the primary quality requirement was for Original Equipment specification parts i.e. as specified and used by the Vehicle Manufacturer when the cars are manufactured. This approval and use by the vehicle manufacturer influences the market's perception of the quality of these parts. An additional requirement expressed in the Installer / Local Distributor (INS/LD) relationship was that the parts carried warranties.

There was some (but not great) customer dissatisfaction (type 3 mismatch) expressed in the installer / local distributor relationship of which the local distributor appeared to be unaware (type 4 mismatch). The local distributor appeared to underestimate the independent garages requirements for quality (type 1 mismatch); also they did not express awareness of problems on specific parts ranges which were identified by the installers (type 2 mismatch).

LD/AD Dyad Moving up the supply chain to consider the views held in the Local Distributor / Area Distributor (LD/AD) relationship, this demand for quality specification was moderated to being a requirement for good brands, but not necessarily Original Equipment. In this relationship both parties agreed about what was required (i.e. no type 1 mismatch existed). The customer was dissatisfied because of a quality problem on packaging, specifically cartons (type 3 mismatch). The supplier was aware of this performance problem (i.e. no type 2 mismatch) and recognised their performance gap (a type 4 mismatch).

AD/M Dyad At the Area Distributor / Manufacturer (AD/M) relationship, because both these parties were Original Equipment suppliers, OE specification was taken as read. The main concern expressed by the customer in this relationship (the Area Distributor) was over packaging quality of palletisation (type 3 mismatch); the shape and form of incoming materials was preventing them from being handled easily by the area distributor. The manufacturer did not appear to appreciate these requirements (type 1 mismatch) nor did they express any perception of quality problems (type 2 mismatch); the supplier, therefore, did not perceive any performance gap (no type 4 mismatch).

To summarise the views of quality requirements and performance in this chain, there was no evidence of either substantial customer dissatisfaction or

substantial misperception in the dyads. Some misperceptions relating to quality existed at the INS/LD and AD/M dyads but not in the intermediate dyad (LD/AD). Some dissatisfaction existed in the chain but this only seemed to be recognised in the LD/AD dyad i.e. whilst this dyad had similar levels of dissatisfaction, at least the supplier in this relationship was aware of it.

The next section considers gaps in perceptions of delivery requirements and performance.

Delivery

INS/LD Dyad All the installers in this supply chain stated that delivery was the most important requirement to them; 30% were demanding delivery within 20-30 minutes. A further 50% required delivery from the local distributor within an hour. In addition to speed, some installers were anxious to have an urgent delivery service of 5-10 minutes i.e. they required delivery speed flexibility. The view expressed by the local distributor in this relationship did not acknowledge this requirement for flexibility of delivery speed. Also the local distributor perceived specific delivery requirements of certain types of installers; the views of these types of installers were not in accord with this i.e. a type 1 mismatch existed.

The installers perceived delivery performance from the local distributor as being in excess of 3 hours, on

average, slower than they required (type 3 mismatch). Interestingly, the local distributor perceived their average delivery speed as being within an hour; this showed a significant difference in perceptions of the 2 parties in this dyad on what delivery performance actually was (type 2 mismatch) and resulted in the local distributor appearing to be unaware of a problem to solve (i.e. no type 4 mismatch).

LD/AD Dyad Moving up the chain to consider the Local Distributor / Area Distributor relationship, in this chain, the local distributor was quite happy with a weekly delivery but wanted 95% availability i.e. when the weekly order arrived, they required it to be at least 95% complete. The area distributor did not perceive their requirements for availability in this way (type 1 mismatch). The customer expressed an unwillingness to trade off delivery availability against quicker delivery speed and were dissatisfied with the performance they received (type 3 mismatch). The main problem in the LD/ AD relationship was the self confessed "lousy" availability from the supplier of 70-80% (no type 2 mismatch) but the supplier did not view this with the same degree of importance as did the customer (type 4 mismatch). The reliability of delivery time was very high; the LD said he could set his watch by the AD turning up at 10.45 am each Wednesday morning but he was not particularly concerned to have this very high delivery reliability.

AD/M Dyad Moving further up the chain, at the AD/M relationship the AD wanted quicker delivery speed; they stated it took from 4-26 weeks from time of order to delivery which they were very dissatisfied with (type 3 mismatch). The manufacturer perceived the area distributor as only wanting their schedule satisfied; however, this schedule was a negotiated schedule which took into account the manufacturer's long fixed lead times (type 1 mismatch). The manufacturer, therefore, did not perceive the extent of the delivery performance problem (type 2 mismatch). The manufacturer perceived the gap between the performance and requirements to be the fault of the area distributor changing their mind i.e. they did not perceive that they needed to improve their own performance (i.e. no type 4 mismatch).

To summarise the views on delivery, all the customers in the dyads in this chain were very dissatisfied with delivery. In addition, there were significant levels of misunderstanding about delivery performance in two of the dyads but some supplier recognition in the intermediate dyad that performance was poor.

Service

In this supply chain the expressed views on service requirements and performance can be grouped into headings of technical support, interpersonal relations and sales order processing areas. Whilst questions were not

expressly asked about each of these aspects of service, these represent the main areas highlighted by the interviewees. It was found useful to separate these out, as shown below.

Service - Technical Support

INS/LD Dyad The installers in this chain did not express an interest in receiving technical support from the local distributor; a frequently expressed view was that they did not believe the local distributor to be any more knowledgeable than them. There were occasions when the installers did need technical support but they chose to use the diagnostic equipment suppliers or to by-pass the local distributor and use the area distributor or even the manufacturer. The local distributor, by contrast, expressed the view that there was a demand for their technical seminars i.e. a type 1 mismatch. The LD perceived that they helped the independent garages with new technology; the independent garages did not appear to share this view i.e. a type 2 mismatch.

As the installers did not expressly require technical support, they were not dissatisfied with performance in this area i.e. no type 3 mismatch. Ironically, the local distributor felt dissatisfied with their technical support performance and that they could be doing even more to help the installers (a type 4 mismatch).

LD/AD Dyad At the next dyad upstream in the chain the Local Distributor made demands for technical support from the Area Distributor, sometimes requiring them to visit their customers (the installers) with them to help solve technical problems. This view was shared by the area distributor (no type 1 mismatch). Both parties shared a view that the area distributor's management of technical support could be improved (no type 2 mismatch) with both parties recognising a performance gap in this area (type 3 and type 4 mismatch).

AD/M Dyad Further up the chain, at the AD/M level, technical support was not expressed as a requirement or a performance problem from either party (no mismatches).

Service - Interpersonal relations

INS/LD Dyad The installers in this chain were unanimous in their apparent distaste with representatives of the local distributor visiting them or having any social contact with them. The local distributor, however, expressed the belief that hospitality and personal representation were important parts of the service package and were valued by the installers. This showed, again, a significant difference in views held of what installers required i.e. a type 1 mismatch. Despite shunning visits from sales representatives, some of the installers expressed the view that they were not "properly looked after", implying that they required a mechanism other than a visit for this to occur (i.e. a

type 3 mismatch). The local distributor, however, perceived them as having close relations with the installers (type 2 mismatch) and that their customers were satisfied with the interpersonal relationships (no type 4 mismatch).

LD/AD Dyad Moving up the supply chain to the next dyad, the Local Distributor claimed to gain confidence from visits from the Area Distributor's representatives. In this relationship the AD saw close dealing with the representatives as one of the most important aspects of the relationship (i.e. no type 1 mismatch). However, the customer (the LD) was dissatisfied with the AD's newly formed "Centre of Excellence" as they now didn't know who do deal with (type 3 mismatch); this difficulty was acknowledged by the supplier (type 4 mismatch).

AD/M Dyad Moving further up the supply chain to the next dyad - the Area Distributor / Manufacturer relationship - no inter-personal relations were expressed as required or as a performance issue by either parties in the AD/M relationship (no mismatches).

Service - Sales Order Processing

INS/LD At the installer end of the chain, answering the phone quickly and politely and giving instant provision of availability information were expressed requirements of the installers. The local distributor focused more attention on moving towards electronic sales order

processing (a type 1 mismatch). The installers placed most orders by telephone as the part requirement was discovered on the vehicle once it was up on the ramp. Typically the mechanic working on the vehicle placed the order; many complained about being left hanging on the phone for unreasonable amounts of time, even before they had been asked who they were. This caused frustration as the mechanics wanted to get on with the repair or service. The local distributor actually praised themselves for answering the phone promptly then asking callers to hold if they were busy (a type 2 mismatch). Many installers expressed dissatisfaction with the way they were treated during the sales order processing process (type 3 mismatch) but the local distributor appeared unaware of any problems relating to this aspect of performance (no type 4 mismatch).

LD/AD Dyad Further up the chain, the Local Distributor wanted to trade electronically with the Area Distributor through EDI; the AD acknowledged that their customers wanted a fast, efficient service which would give them instant availability information (no type 1 mismatch). The AD had recently made organisational changes by forming a "Centre of Excellence" to act as a focal point for all ordering and enquiries; however, both parties agreed that this was not working too well at the time of the interviews (no type 2 mismatch) which caused possibly temporary customer dissatisfaction (type 3 mismatch) which was acknowledged by the supplier (type 4 mismatch).

AD/M Dyad Both parties recognised that the customer in this relationship wanted to place orders within the lead time recognised by the Manufacturer (no type 1 mismatch). However, a large gap existed between both parties' perceptions of performance. The senior managers at the Manufacturer were claiming to treat this particular aftermarket customer as being as important as their other customers (predominantly the Original Equipment manufacturers); the Area Distributor perceived this as being a facade behind which the real treatment from lower levels of management made them know that they were "a pain in the bum" and a "real buggeration" (type 2 mismatch). Strong dissatisfaction was expressed by the area distributor (type 3 mismatch) of which the manufacturer appeared unaware (type 4 mismatch).

To summarise the views on service, there was a significant amount of customer dissatisfaction with service, particularly in the LD/AD and AD/M dyads. Interestingly in these dyads there appeared to be no misunderstanding about what was required but significant misunderstanding about performance. In the INS/LD dyad there was significant misperception about both requirements and performance.

Range

INS/LD Dyad In the Installer / Local Distributor relationships there was some agreement that a wide range

of parts was required (no type 1 mismatch) and that, generally, the supplier held a reasonably good range, with some exceptions (small type 2 mismatch). If their supplier held a wide range, this enabled the installers to buy most of the parts required for any job from one source of supply - a practice known in the industry as "one-stop shopping". 40% of the installers interviewed specifically were aiming to do one-stop shopping. With some exceptions, the installers expressed relatively little dissatisfaction (small type 3 mismatch) and the local distributor did not acknowledge any substantial performance gap (no type 4 mismatch).

LD/AD Dyad By contrast in the next dyad upstream, the Local Distributor viewed single sourcing, or one stop shopping, with fear of over dependence. They specifically limited purchases with any one supplier to a maximum of 15% of their spend. They preferred instead to use many suppliers, each of who could offer depth within ranges rather than breadth across ranges. The Area Distributor did not appear to be aware of this and thought that this customer wanted a wide range and an "all makes programme" that gave breadth across all manufacturers ranges (type 1 mismatch). These different perspectives then affected views of performance. The LD was critical over range depth whereas the AD was self-congratulatory over their range breadth (type 2 mismatch). The customer in this relationship (the LD) was slightly dissatisfied about this (type 3 mismatch) whereas the supplier (the AD) did

not acknowledge as much of a performance gap (no type 4 mismatch).

AD/M Dyad Moving upstream, the Area Distributor bought parts from over 2000 suppliers, though they were trying to reduce this number, and increase the range bought from remaining suppliers; the manufacturer agreed that the area distributor required a wide range (no type 1 mismatch). This presented a performance problem as the AD was experiencing difficulty in sourcing the tail of C items (by Pareto analysis of value / volume) (type 3 mismatch) which was partially acknowledged by the manufacturer (type 4 mismatch).

To summarise the views on range, these were mixed within this supply chain. The INS/LD relationship was relatively harmonious. The LD/AD relationship contained significant misperception of range requirements but this did not adversely affect performance or customer satisfaction. In the AD/M relationship the customer dissatisfaction appeared to arise from the misperception of performance.

Price

INS/LD Dyad The views of price requirements were mixed in this dyad. About half the installers appeared to be quite price conscious and spent time ringing round suppliers to get the best price for a part; in particular the fast-fit and menu service installers were in this group. Others, however, stated they did not bother comparing prices in

this way. There appeared to be little evidence of installers wanting to buy in volume to gain price discounts.

The Local Distributor highlighted interesting complexity to price requirements - it was explained that some installers would choose parts according to discount offered against list prices. e.g. some installers would buy a Brand X part for £9.00 with a list price of £10.00 so they could charge it on to the car owner (their customer) at a margin on the part of £1, in preference to buying a Brand Y part for £8.00 with a list price of £8.50 which they could only charge on with a margin of £0.50 (subject to certain quality requirements regarding the perception of the brand). There was therefore some agreement on what was required (no type 1 mismatch). Some of the installers were unhappy with prices on specific part ranges (type 3 mismatch), a view of performance which the supplier did not express (type 2 mismatch). Rather the supplier was specifically concerned about its pricing performance to fast-fit and menu service installers (type 4 mismatch).

LD/AD Dyad Further up the chain, the Local Distributor claimed and was recognised to be not too price sensitive, wanting "competitive, not brilliant" prices (no type 1 mismatch). The LD expressed particular dissatisfaction with prices of factored parts and with the Case Company's pricing policy to its own local distributors, giving them

price advantage (type 3 mismatch). Whilst the area distributor recognised some problems (type 4 mismatch) there was still a gap in both party's views on price performance (type 2 mismatch).

AD/M Dyad It appeared that the Area Distributor was benefiting from tied relationships with the Manufacturer and was getting parts for the aftermarket at relatively competitive prices. There was no disagreement between the parties about the customer's requirements (no type 1 mismatch) but their views of price performance were not in accord (type 2 mismatch). The views on price expressed by the Manufacturer were of displeasure about the AD "riding on the back of, and profits from, the OE business". The customer was not dissatisfied (no type 3 mismatch) whereas the supplier felt they were over-performing on price (type 4 mismatch).

To summarise views on price requirements and performance in this chain, there was little evidence of customer dissatisfaction regarding price though some misperceptions of performance were evident.

Discussion of UK Braking Chain Performance Dimensions

Much of the discussion in the interviews tended to concentrate on delivery requirements and performance. This is not surprising in an aftermarket supply chain where requirements are injected into the supply chain

with little forward knowledge and performance to the end customer is expected to be within an hour.

The reluctance of installers in this chain to buy in volume to get bulk discounts is likely to be a contributory factor to their increasing demands for delivery speed and delivery flexibility, thereby increasing their focus on this dimension of performance.

In this chain each relationship contained a range of misperceptions of views of requirements and performance across each of the performance dimensions. No one relationship appeared to stand out as being significantly better or worse in terms of customer satisfaction or misunderstandings in the relationships. Each dyad contained substantial customer dissatisfaction and also substantial misperception of requirements and performance, however, some observations of differences between the dyads can be made.

All three dyadic relationships exhibited customer dissatisfaction with delivery and service performance in particular. None showed much evidence of customer dissatisfaction about price.

The INS/LD and the AD/M relationships appeared to contain substantial supplier complacency in terms of failing to recognise the level of customer dissatisfaction whereas in the LD/AD relationship the supplier (the AD) appeared

to be more aware of their shortcomings (i.e. greater T4 mismatches were evident).

The requirements within each performance dimension differed between relationships. For example, the range requirements in the chain switched from single sourcing / wide range at the INS/LD dyad, to multi sourcing / narrow but deep range at the LD/AD dyad then back to single or dual sourcing / wide range at the AD/M dyad.

Each of the other supply chains will now be considered before comparisons are made between the chains. The results for the next 3 chains will be in more summary form.

SPANISH BRAKING CHAIN

Brief Description of the Spanish Braking Chain

The Spanish braking chain chosen was a route for braking products, such as brake cylinders, from a Spanish manufacturer in Northern Spain, through an area distributor in Central Spain to a local distributor in North Eastern Spain, to a set of 10 Spanish installers located in the vicinity of the local distributor in North Eastern Spain. The chain is represented by the figure below:

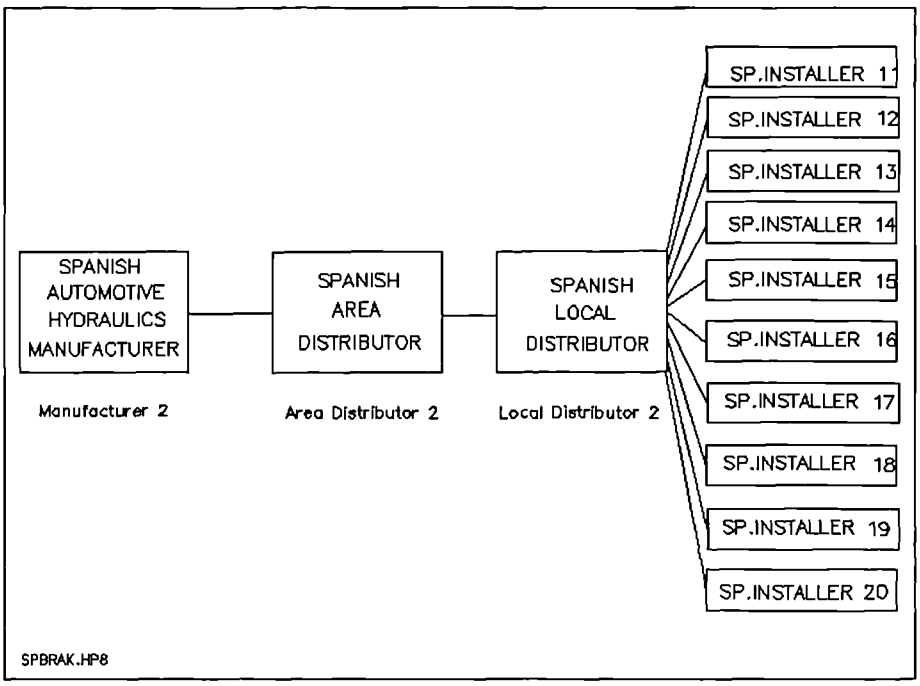

Figure 10.7: Spanish Braking Chain

Summary profiles of the companies involved in this chain are provided in Appendix 1.

Performance dimension Comparisons

Quality

There was very little evidence of customer dissatisfaction (type 3 mismatches) in this supply chain regarding quality. There was some evidence of misperception of requirements (type 1 mismatch) in the INS/LD and AD/M relationships but not in the intermediate dyad. There was more evidence of misperception of quality performance in the AD/M dyad than in the other 2 dyads. The supplier in the AD/M relationship perceived a performance gap regarding quality, (despite the

satisfaction of the customer in that relationship); overall, little concern was expressed to improve quality.

Delivery

All the installers in this set identified delivery as being their most important requirement. They expected delivery to be within an hour of placing the order and insisted that it was within 2 to 3 hours.

The delivery requirements of customers were well understood at the INS/LD and LD/AD dyads (i.e. no type 1 mismatches) but the supplier's and customer's perceptions of requirements were substantially different at the AD/M dyad. Here the area distributor wanted delivery within 3 weeks whereas the manufacturer perceived that 4 weekly delivery was satisfactory i.e. a large type 1 mismatch existed.

Misperceptions of performance (type 2 mismatch) existed at the LD/AD and AD/M dyads. The nature of the misperception in these 2 cases differed. In the LD/AD dyad the area distributor expressed the view that there were not many complaints from customers about late delivery whereas the local distributor expressed disappointment that delivery performance had got worse. In the AD/M dyad the manufacturer was aware of the customer discontent but disputed its validity as they disagreed with the performance measurement system used.

Customer dissatisfaction regarding delivery (type 3 mismatch) appeared to get worse further up the chain. At the AD/M dyad, the customer in that relationship measured delivery performance from the manufacturer at 70% when measuring conformance of delivery to date required. There was very little evidence of recognition of the performance gap by the supplier (i.e. no type 4 mismatch) whose performance measures showed that there had been no late deliveries of backlog in the last 6 months.

Service

The INS/LD dyad appeared to be perfectly harmonious regarding service. The local distributor was aware of the installers' requirements for technical support, inter-personal relations and sales order processing and satisfied those requirements. i.e. no mismatches existed.

At the next dyad upstream, (LD/AD dyad) there were some misperceptions of requirements (type 1 mismatch) relating to the supplier's understanding of technical support requirements and the trust and loyalty required in the inter-personal aspect of the relationship. There were also misperceptions of performance regarding these issues (type 2 mismatch); in particular the local distributor viewed the technical support performance of the area distributor to be "by-passing" them, going direct to the installer, whereas the area distributor preferred to consider this as a healthy "3 way relationship". This resulted in the local distributor being dissatisfied with

the technical support and inter-personal aspects of the relationship (type 3 mismatch). The area distributor, however, identified a performance gap in the deteriorating inter-personal contact and lack of co-ordination of this.

Range

There was evidence of substantial customer dissatisfaction in this chain regarding range. Even the otherwise harmonious INS/LD dyad showed some dissatisfaction regarding this dimension of performance, though in this relationship both parties clearly understood the problems. In contrast the other 2 dyads in the chain showed substantial misperception about performance in addition to customer dissatisfaction. The LD described the AD's range as "patchy" whereas the AD felt that they offered the best range in the market.

Price

There was little evidence in this chain of concern of misperception over price except at the AD/M dyad where there was substantial customer dissatisfaction. The Area Distributor expressed the view that they should be able to make 12.2% margin on parts bought from the braking Manufacturer; this was not understood by the supplier (type 1 mismatch). The prices had been fixed contractually so there was no misunderstanding about performance (no type 2 mismatch). However, the customer was dissatisfied (type 3 mismatch) and questioned whether

they were making any profit at all on the parts supplied by the manufacturer, who did not appear to acknowledge a performance gap (no type 4 mismatch). The Manufacturer appeared to be focussing attention on reducing prices to the Original Equipment side of their business.

Summary of Spanish Braking Chain Performance Dimensions

One relationship in this chain - the INS/LD relationship - stood out as a shining example of harmony. There was very little evidence of misunderstanding of requirements or performance in this dyad. There was very little dissatisfaction expressed, except a moderate amount relating to range problems but both parties clearly understood these.

By contrast there was an exceptionally large amount of misperception and customer dissatisfaction further up this chain at the level of the area distributor / manufacturer.

In between these 2 dyads, the local distributor / area distributor dyad exhibited a small amount of misunderstanding about customer requirements, but quite high levels of confusion about performance and quite high levels of customer dissatisfaction.

It was clear in this chain that misperceptions associated with delivery, service, range and price increased further

upstream. Customer dissatisfaction with delivery, service and price likewise increased upstream. Because the suppliers in the relationships with poor performance generally did not recognise the performance gap, any improvement in the current situation without further intervention is unlikely.

By comparison the INS/LD relationship appears to be harmonious whereas the AD/M relationship appears tense and confused.

UK ELECTRICAL CHAIN

Brief Description of the UK Electrical Chain

The UK Electrical Chain chosen was a route for starters and alternators from a UK manufacturer in Central England, through a UK area distributor in Central England, to a UK local distributor in Northern England then to a set of 10 UK installers based around the Local Distributor in Northern England. The chain is represented in the figure below.

Summary profiles of the companies involved in this chain are provided in Appendix 1.

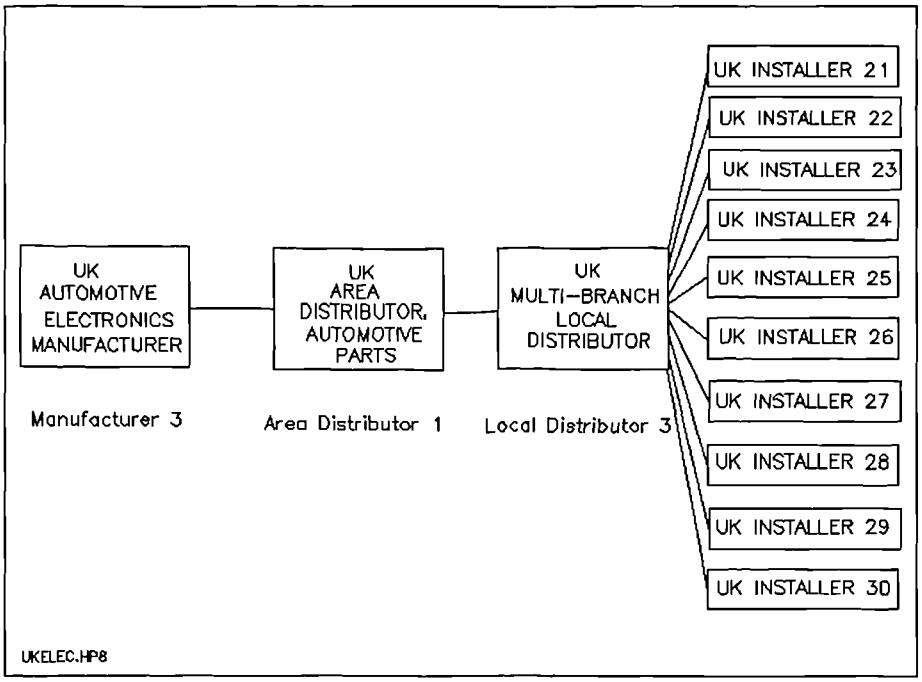

Figure 10.8: UK Electrical Chain

Performance dimension Comparisons

Quality

At the INS/LD dyad there was little evidence of customer dissatisfaction with quality or of misperceptions of quality requirements and performance. There were more misperceptions of requirements and performance at the next 2 dyads upstream, but these were not great. Most of the customer dissatisfaction with quality occurred in the intermediate dyad - the LD/AD dyad. The LD was more concerned than the AD about the declining brand quality. The AD was instead focusing on gaining BS5750 and described this as key to providing customer service. There were also misperceptions in this relationship about requirements; the LD wanted parts with a strong brand image, preferably OE parts. This view contrasted with

that of the Area Distributor whose market research using trade-off analysis showed brand to have the lowest utility when compared to other factors.

This difference in quality focus was evident also in the AD/M dyad; the Manufacturer's quality focus was very much on internal systems improvement via BS5750 whereas the Area Distributor was concerned that the OE penetration should be increased by focusing on manufacturing higher quality parts. This appears to be a contrast of process orientation versus output orientation.

Delivery

In this chain there appeared to be little evidence of misperceptions regarding delivery but significant customer dissatisfaction which increased further upstream.

Delivery was obviously an important dimension of performance in this chain. Most of the installers interviewed considered delivery to be the most important factor to them. The Local Distributor wanted quick delivery for the slow moving items which they didn't stock. The Area Distributor wanted delivery reliability with predictability of a specific window.

In this chain the delivery performance problems were well understood, particularly by the Area Distributor and the Manufacturer. The AD admitted to first time pick

performance of only 75-78%; their logistics manager stated "I would guess that very few people come to us purely because we are an excellent deliverer of parts". The Manufacturer recognised their own poor performance but did not appear motivated to do anything about it. According to the Area Distributor, only about 30% of deliveries were on time in a delivery window of "any time during the month". The Manufacturer admitted that it was their policy to satisfy urgent short notice orders for the Original Equipment manufacturers often at the expense of the Aftermarket. They also willingly stated that the OEMs received an extremely flexible service in terms of daily changes to delivery requirements; they clearly accept poor performance to the aftermarket and do not appear to be motivated to improve.

Service

The INS/LD and LD/AD were almost perfectly harmonious regarding service issues with no evidence of dissatisfaction and only very slight misperception of requirements at the INS/LD dyad. The local distributor's technical support was described as "brilliant" and the inter-personal relationships as "personal" and "sociable".

This contrasted sharply with the AD/M relationship where the AD was very dissatisfied, particularly with the sales order processing service provided. The AD wanted to be able to order parts for delivery on specific dates sp

they could plan their handling and packaging requirements. The Manufacturer would only deliver sometime during the month. The Manufacturer's perspective was that the Area Distributor was disorganised in expecting them to work to these irregular scheduled deliveries.

Range

There was a constant level of customer dissatisfaction through this chain regarding range but this was only recognised by the supplier in the INS/LD dyad. The range performance appeared mixed; for example, in the LD/AD dyad the ignition parts range were perceived as very good but switchgear and lighting as "mongrel". This poor performance was not recognised by the AD who believed they were number 1 in the electrical market and appeared satisfied with their range performance.

The misperception of requirements was constant through the chain, but it appeared that misperception of performance increased further upstream.

Price

Half the installers in this chain claimed not to be that price conscious; those that stated some price requirements used phrases including "reasonable" and "sensible" rather than cheap or low. However, there was some customer dissatisfaction with price in this chain, in the LD/AD and AD/M dyads.

In the LD/AD dyad the LD was satisfied with prices charged to them but were more concerned with unrealistic recommended retail prices, such as on bulbs. In the AD/M dyad the AD was aware that this Manufacturer's prices were not competitive and were trying to source from alternative manufacturers.

There was evidence of misperception of both requirements and performance in this chain regarding price. For example, in the LD/AD dyad the AD had performed trade-off analysis which lead them to perceive local distributors' requirements as being focussed on favourable credit terms, particularly in the north of the country. This view was not expressed by the LD who wanted tight discount structures to be adhered to.

Dyad Comparisons

Customer dissatisfaction exists in each of the dyads and appears to get worse in the upstream dyads. This trend appears to be significantly influenced by the increasing dissatisfaction with delivery performance. The suppliers' recognition of performance problems also gets better upstream but does not appear to recognise the performance gap as being as large as the customers perceive it to be.

Similarly there is evidence of confusion regarding both requirements and performance which also increases upstream.

SPANISH ELECTRICAL CHAIN

Brief Description of the Spanish Electrical Chain

The Spanish Electrical Chain chosen was a route for engine management system components from a UK manufacturer in Central England, through a Spanish area distributor in Central Spain, to a Spanish local Distributor in Northern Spain to a set of 10 installers based around the Local Distributor in Northern Spain. The chain is represented in the figure below:

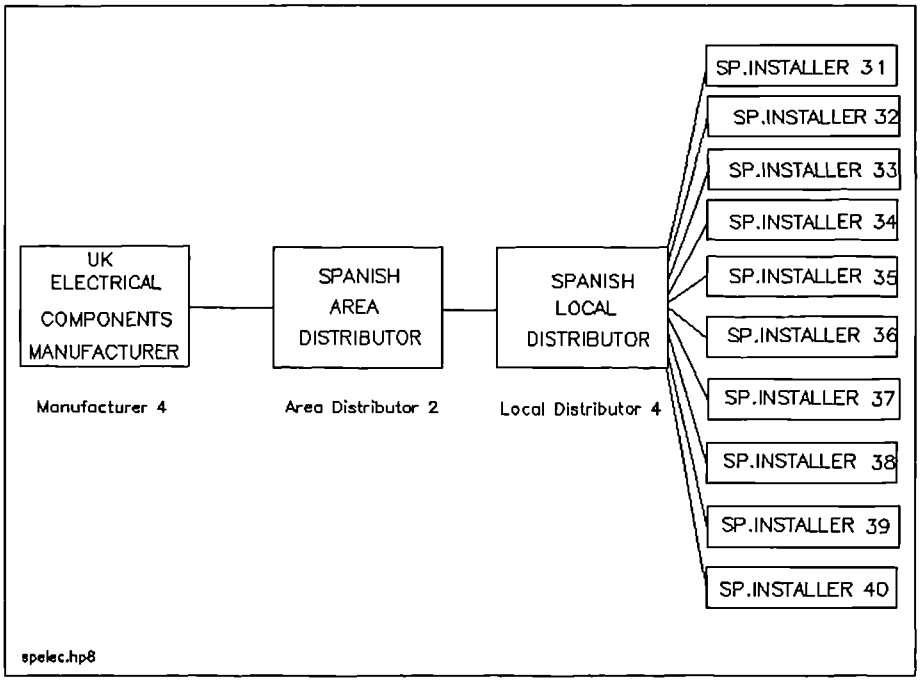

Figure 10.9: Spanish Electrical Chain

Summary profiles of the companies involved in this chain are provided in Appendix 1.

Performance dimension Comparisons

Quality

There was evidence of substantial customer dissatisfaction regarding quality in this chain in the LD/AD and AD/M dyads. Most of this related to the specification of the parts not being up to Original Equipment standards. This is interesting as the end customers in the chain (the installers) required good quality but not necessarily OE standard - they were generally happy with quality.

In addition, the AD complained about conformance problems; the manufacturer supplying them accepted that about 5% of parts would be returned because of failure but the AD wanted this to be lower.

Delivery

Once again, customer dissatisfaction with delivery appeared to become greater further up the supply chain. At the INS/LD there was only dissatisfaction expressed about delivery performance when a part wasn't in stock at the Local Distributor; the LD sent an employee by bus to pick the part up which took 2 hours or more.

At the next dyad upstream, the LD was concerned with availability rather than speed. If parts were in stock at the AD they were delivered in 24 hours. However, if they weren't in stock the LD could not wait for them.

In this chain there was no evidence of confusion about delivery requirements and only evidence of misperception of performance in the LD/AD dyad. In this relationship the Area Distributor was self-congratulatory in expressing the view that delivery performance was improving substantially and felt that they gave one of the best services in the market place for stock orders and emergency orders. One possible reason for mismatch of views on performance could be the self-confessed difficulty with the AD's performance measurement system of pick rates; apparently the system in place allowed pick rates to be >100% because of the unusual treatment of back orders.

Service

The views on service were mixed in this chain. There was evidence of customer dissatisfaction in the INS/LD and LD/AD dyads but not in the AD/M dyad.

Half of the installers interviewed wanted technical support from the local distributor and saw it as a key part of their role. However, some of the installers expressed dissatisfaction with the technical support provided by the Local Distributor; they apparently were not much help on parts for newer vehicles in particular. To get over these problems, the installers by-passed them and went direct to the manufacturer with technical queries.

The local distributor was dissatisfied that they were penalised by additional delivery charges for ordering within a weekly time bucket. The Area Distributor's view was that their system was geared up to weekly ordering.

Range

There was substantial customer dissatisfaction in this chain associated with range. In this chain 90% of the installers interviewed expressed a requirement to do one-stop shopping, and therefore they required a very wide range. Half of the installers specifically required access to new parts and were dissatisfied with the range performance for these parts.. This was in contrast to the Local Distributor's view in this dyad who perceived the installers as attending to cars over 3 years old, therefore as having limited requirements for new car parts. The LD recognised a substantial problem with their range performance and awarded themselves "6.5/10".

In the next dyad in the chain, the Area Distributor appeared to dictate range to the Local Distributor; they had strict rules about which ranges they let the LD take and, if they took a range, about taking all of it and not part of it. The Local Distributor agreed that the AD decided that. The LD was dissatisfied with the extent of coverage of the car parc; this contrasted with the Area Distributor's view that they offered the widest range in the market.

At the Area Distributor / Manufacturer dyad, the main cause for customer dissatisfaction and misperception related to parts for new vehicles. The AD stated that these should be available the same time as the vehicle is first on the road. The Manufacturer's view is that they should be available to the Aftermarket once the warranty period has expired on the vehicle. This is a cause for dissatisfaction in the aftermarket and arises because of the protection of the vehicle manufacturers agents by the component manufacturers. It transpired in interviews that the component manufacturers reach agreements with the vehicle manufacturers not to sell spares to the aftermarket other than to their own franchised agents for a period of time to guarantee them all work within the vehicle warranty time period, whether the particular parts are covered by warranty or not. In addition there were some performance problems identified by both parties; the range carried by the Manufacturer was agreed as being large and the Manufacturer had self-confessed problems of managing it well.

Price

There was very little evidence of any customer dissatisfaction in this chain associated with price. There was only evidence of misperception of requirements and performance at the AD/M dyad. Here the 2 parties appeared to focus on very different aspects of price. The AD was concerned with prices relative to other

competitors; the Manufacturer's focus was more on a cost plus view.

Dyad Comparisons

No one dyad in this chain stands out as being exceptionally different to the others in terms of customer dissatisfaction and the amount of misperception about requirements and performance. Customer dissatisfaction exists in each of the dyads but in this chain there is no evidence of substantial deterioration with progression upstream.

Having completed the first two steps of qualitative analysis within the dyadic relationships, the next section considers analysis of a higher level by comparing qualitative results across supply chains.

CROSS DYAD COMPARISONS

Across the four supply chains it is difficult to make comparisons of all the 12 dyadic relationships within those chains. However, some observations can be made.

One dyad - the INS/LD dyad in the Spanish braking chain, stood out as a shining example of harmony and satisfaction. In this relationship the supplier appeared to be entirely in tune with the requirements of the installers and the installers exhibited a very high level of satisfaction with the relationship. They were only

substantially dissatisfied with range performance and the supplier appeared fully aware of the problems here.

Whilst not measured in this research, the motivation and commitment exuded by the local distributor in this relationship was apparent in all of the employees interviewed but was obviously generated by the proprietor who was a highly professional and likeable business man.

In contrast, some sour relationships were evident, in particular the AD/M relationships in the UK braking and electrical chains and in the Spanish braking chain. These relationships exhibited high levels of customer dissatisfaction. They also showed evidence of substantial misperceptions between the parties, particularly relating to performance. The suppliers in these relationships showed less recognition of the gap in performance than did their customers who complained bitterly about them. Where the suppliers did recognise the performance gap, they often blamed their customers and showed little evidence of motivation to improve their own performance.

CROSS PERFORMANCE DIMENSION COMPARISONS

From the analysis within each of the dyads, certain patterns in the data are apparent.

It appears that there is little evidence of dissatisfaction or concern in these chains about price as a dimension of performance. Most dissatisfaction appears

to be with delivery; this is not surprising as the nature of the products are distress purchases ordered at the end of the chain by telephone with an expectation of delivery within hours. The requirements are therefore very demanding. However, what is surprising is that dissatisfaction with delivery is so high further up the supply chain where deliveries are not made within an hour or even weekly but often monthly. Therefore it appears that this dissatisfaction may not necessarily be caused by unreasonable expectations but rather as a result of poor performance.

After delivery there appeared to be more problems associated with range and service than with quality. Product quality is more likely to be taken as read in aftermarket chains as quality is judged by OE approval and brand (i.e. specification and reputation using Garvin's 1987 dimensions) rather than by conformance, durability or reliability.

Service requirements were grouped into the headings of technical support, inter-personal relations and sales order processing. Variation for requirements under each heading appeared to be associated to position in the supply chain. Further upstream there were less stated requirements of inter-personal service or technical support and more relating to sales order processing i.e. service requirements upstream appeared to be more system oriented and less people oriented.

Range requirements varied considerably. Some organisations wanted a wide range so they could do one stop shopping whereas others refused to become that dependent on their suppliers. It appeared that more customers wanted wider range because of moving to single sourcing than wanted to maintain multi-sourcing.

There appeared to be confusion in the relationships over range breadth and range depth requirements and performance, breadth referring to the number of lines carried and depth referring to the number of separate part numbers carried within the line.

To summarise there appeared to be significantly more customer dissatisfaction arising from delivery issues than all the other performance dimensions, though service and range appeared to cause noticeable problems in the chains.

CROSS MISMATCH TYPE COMPARISONS

It was difficult to make qualitative comparisons across all the data for each type of mismatch. However, 2 observations were made.

(i) There appeared to be more confusion in the relationships associated with performance than with requirements i.e. type 2 mismatches appeared greater than type 1.

(ii) The customers' perceptions of a performance gap appeared to be much greater than the suppliers' i.e. type 3 mismatches appeared greater than type 4.

These differences will be established using more rational, objective methods in the next chapter.

CROSS CHAIN COMPARISONS

This section deals with the qualitative data at a higher level of aggregation by analysing and making comparisons across chains; this is depicted below in figure 10.10.

Reflecting on the data collected it can be observed that the UK Braking chain appeared slightly different to the other three chains studied in three areas:

(i) There seemed to be significantly more confusion about performance than about what was required in the relationships in this chain.

(ii) This chain seemed to contain more customer dissatisfaction than the others, (but not a significantly greater amount as the other three chains all exhibited dissatisfaction). This was noticeable particularly relating to delivery and service issues.

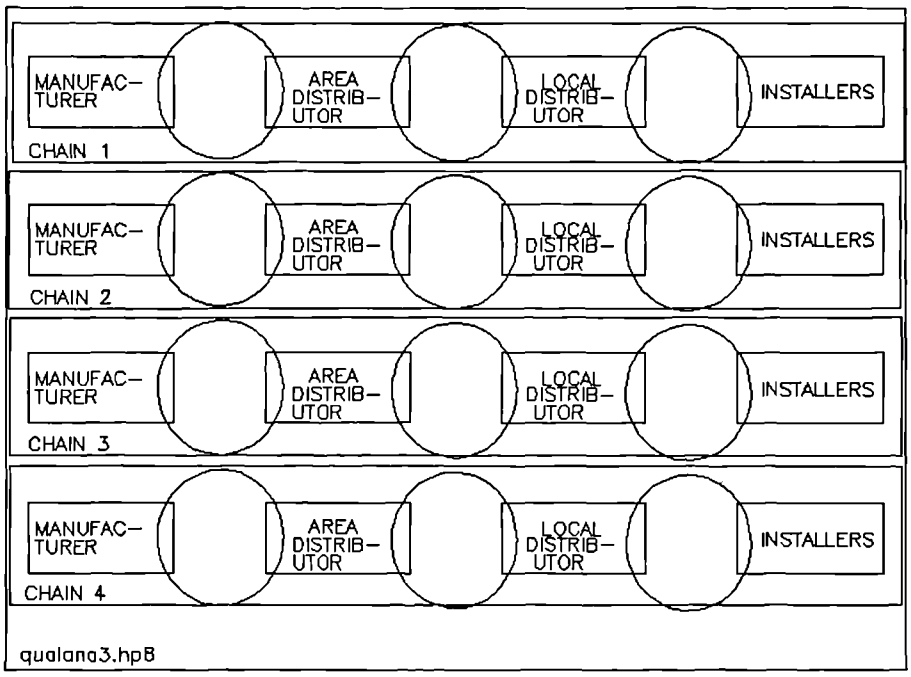

Figure 10.10: Depiction of cross chain analysis performed

(iii) There appeared to be a larger gap in this chain between what suppliers recognised as being the performance gap and the performance gap perceived by the customers but, again, this gap appeared to exist in other chains as well.

No one chain stood out as being a shining example of total understanding between the parties involved as to what was required or what performance levels existed; similarly, no one chain appeared to be significantly worse than any other.

On balance, consideration of the qualitative data does not indicate any great differences between the four chains at an aggregate level of qualitative analysis

across all performance dimensions and types of mismatch in all relationships in the chain. However, underneath this aggregate level some differences were observable but this does not appear to lead to any significant difference at the chain level of analysis.

However, the qualitative data was quite difficult to manage to perform cross chain comparisons. Therefore, to analyse this more objectively and rationally, cross chain comparisons are performed in the next chapter on quantitative analysis.

CROSS TERRITORY COMPARISONS

This section considers the data at a still higher level of aggregation by considering the combined qualitative results of the 2 UK chains and comparing them with the combined results of the 2 Spanish chains, as depicted below in figure 10.11.

Observable differences were noted between the UK and Spanish territories in the chains studied in 3 main areas:

(i) Requirement for Original Equipment parts

(ii) Service requirements

(iii) Range requirements

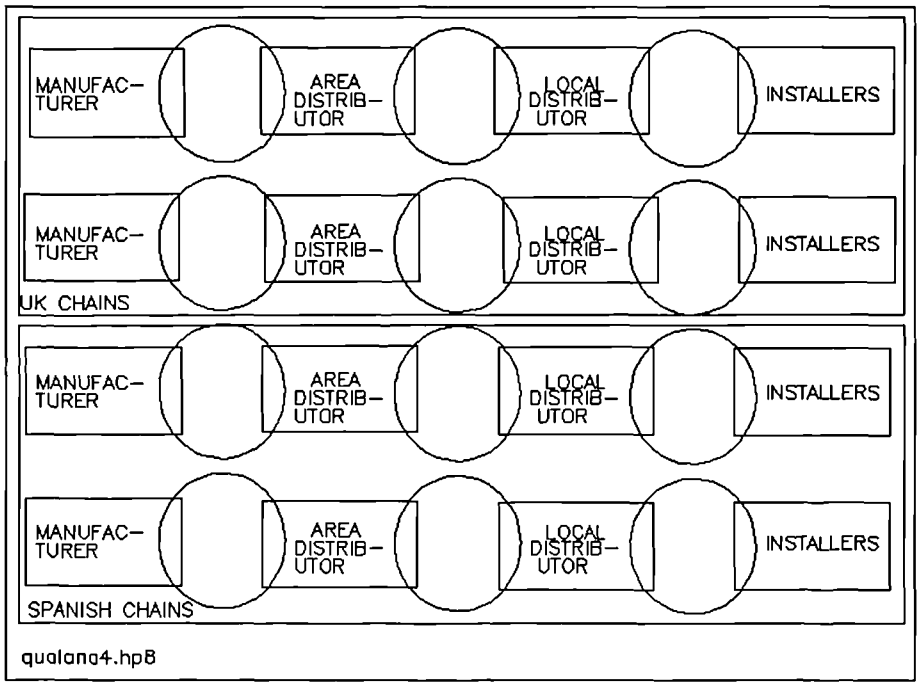

Figure 10.11: Depiction of the cross territory qualitative analysis performed

(i) Requirement for Original Equipment parts

It was noticeable that, at the ends of the supply chains studied, the UK installers tended to favour OE brands far more than their opposite numbers in the Spanish chains. However, despite the Spanish installers' apparent ambivalence over whether parts were Original Equipment or a good brand, the supply chains behind appeared to perceive OE brands as important.

(ii) Service requirements

There were marked differences at the installer level of the supply chain studied between the UK service requirements and those in Spain. A summary table below of comments made in interviews illustrates some differences.

The UK installers, particularly those located in the south of the UK, appeared cold towards their local distributor and did not appear to value any form of social contact. There was little evidence or feeling of trust in the relationship. The Spanish installers, by contrast, valued the closeness and friendship associated with the relationship. It was common practice amongst the Spanish installers to go for a drink after work with their suppliers and to invite them to family events; frequent reference was made to long standing family ties between both parties. Several of the installers specifically mentioned allowing the sales representatives to enter their stores, check which parts were required, replenish them then raise an invoice for the parts supplied; this involves a significant trust between both parties.

Another difference between stated service expectations of installers in the 2 countries related to practice if parts were not in stock at the local distributor. In the UK, it was common practice for installers to ring round suppliers to locate a part. In Spain, however, the installers tended to ring their favoured local distributor who, if he didn't have the part available, would ring round competitors to source it. This part sourcing service does not appear to be such a common feature of the UK Aftermarket.

UK	SPAIN
Wants immediate availability of information. Likes to know people at the supplier so he can "growl at them".	Wants a supplier to look for a part if it's not in stock. Needs to be able to place orders by phone for urgent parts and for distributors to come and restock for them for repeat parts (and on their own if storemen aren't there) - trust and confidence in the rep. is required because of this. Wants friendship; wants an intimate relationship with suppliers. Where more than one stocks a part, he'll choose on the basis of his relationship with one.
No services are required from the local distributor; he gets technical information from elsewhere.	Wants to be well looked after. Wants a very correct relationship. Wants faulty parts to be swapped.
No service expectations	Values a good relationship with the rep.
Not really interested in service aspects	Does not want a woman in charge at the local distributor - believes it will mean poor service. Wants friendship from the relationship. In the future there will be a greater need for technical information as the car parc is changing so much.
Wants promptness in answering the telephone	Friendly relations are essential for the survival of the business. In the future, the installer will need to have access to diagnostic test equipment. He also sees the local distributor as having to provide more technical support and advice.
Wants accuracy and efficiency in invoicing	Wants suppliers to have experience and knowledge. Wants suppliers to trouble themselves to locate parts. Wants friendly relations with sales people; it is important that sales people have good technical knowledge and experience so they can advise the workshops on appropriate parts.
Wants accuracy in interpreting the order	Wants technical information and training.

Table 10.1: Differing service expectations of installers

The Spanish installers tended to see provision of technical support as more important in the relationship than did the UK installers who expressed more confidence in their own technical abilities or, if they needed support, would go elsewhere rather than use the local distributor.

(iii) Range requirements

Regarding differences in range requirements, the Spanish installers expressed expectations for gaining access to newer car parts which the UK installers did not. This could be due to the shifting car parc in Spain; the recent proliferation of foreign models in what was previously a predominantly Seat parc is filtering through to the Aftermarket, causing changing range expectations.

To summarise these differences between territories, it appears that there are marked differences in requirements between the territories. However, this research is concerned with performance in supply chains which is judged by levels of customer dissatisfaction in the context of misperceptions between parties about requirements and performance. It is therefore concerned with gaps and, in this section, with trends in gaps between territories.

Despite these differences in requirements, there is no apparent evidence from the qualitative analysis that chains in either territory exhibit marked differences in

terms of customer satisfaction / dissatisfaction. There was some apparent difference in the suppliers' recognition of problems, however, between the territories. It appeared from the data that the UK chains were slightly more complacent than their Spanish equivalents.

On reflection of the data it appears that the Spanish chains showed slightly clearer understanding of what was required that did their UK equivalents. However, both chains exhibited similar levels of confusion about performance

It appears, therefore, that these marked differences in actual requirements in the two territories were not reflected in significant differences in terms of customer dissatisfaction or gaps in perceptions in the chains.

However, as with the cross chain comparisons, further analysis can be performed using more objective, rational, quantitative methods; this is performed the next chapter.

CROSS PRODUCT TYPE COMPARISONS

This section is at the same level of aggregation of data as the previous section but slices the qualitative data in a different way, in this case by comparing the 2 braking product supply chains with the 2 electrical product supply chains, as depicted below in figure 10.12:

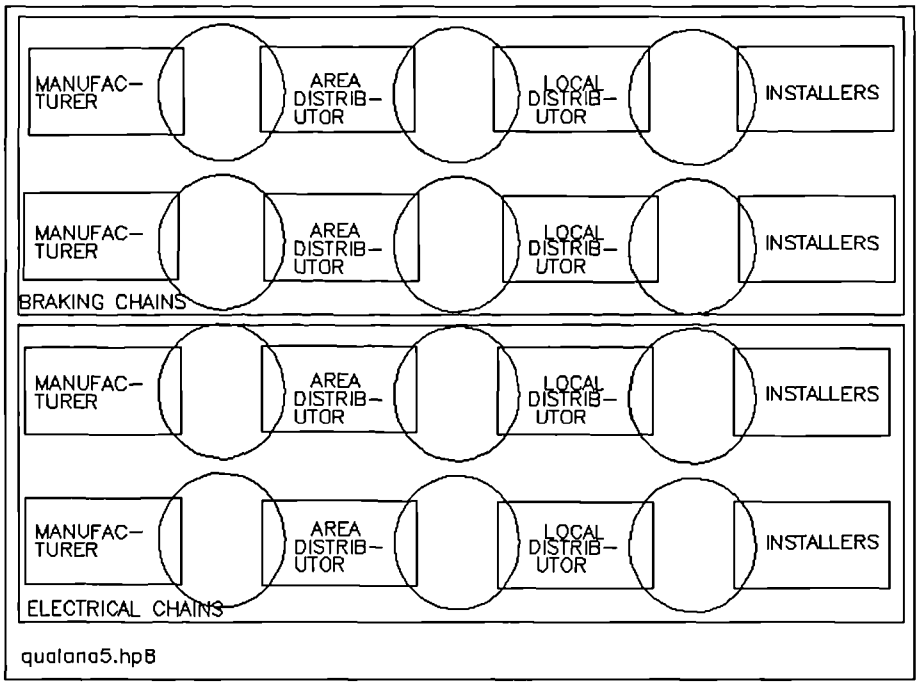

Figure 10.12: Depiction of cross product type qualitative analysis performed

There were noticeable differences in requirements between the braking and electrical chains; installers in electrical chains tended to require more technical support than those in braking chains. This could be due to the changing technology associated with electrical and electronic componentry in vehicles and the associated diagnostic testing equipment now necessary. The effect of the rate of change of technology has appeared to have affected installers in electrical chains more than in braking chains.

However, there were no great differences between the braking chains and the electrical chains in terms of the extent of misperception and dissatisfaction.

Again this data would benefit from quantitative treatment to further this cross product comparison. This is performed in the next chapter on quantitative analysis.

CROSS DYADIC LEVEL COMPARISONS

This section takes the total data set and slices it in another way, this time by dyadic level i.e. by grouping together results for all the INS/LD, LD/AD and AD/M dyads across the 4 chains and making qualitative comparisons between them. This is depicted in figure 10.13 below:

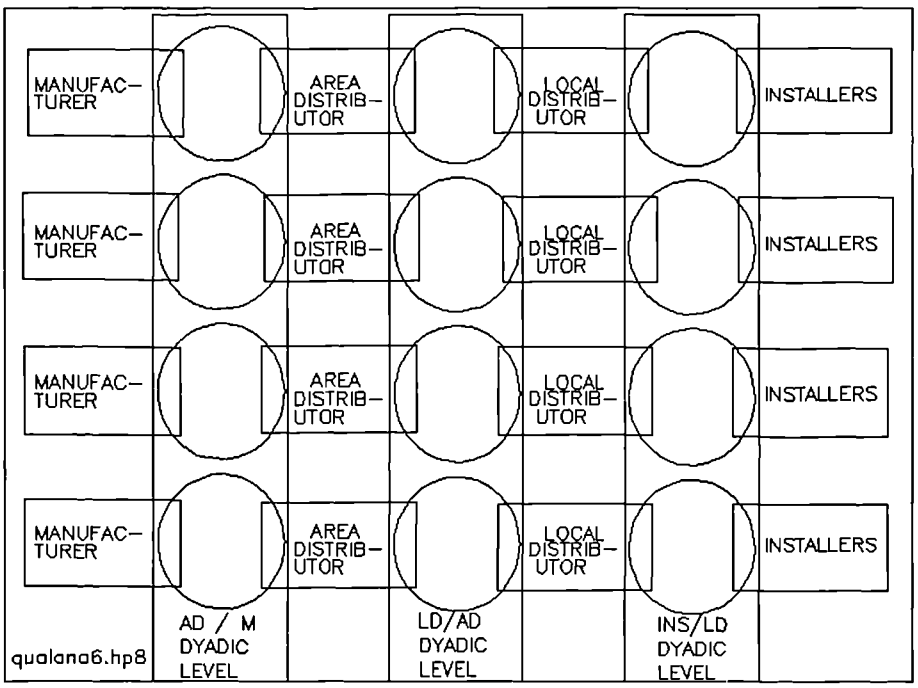

Figure 10.13: Depiction of cross dyadic level qualitative analysis performed

It came across quite strongly in the interviews that significant differences existed between the dyadic relationships upstream and those downstream in terms of:

(i) the level of understanding of requirements

(ii) the agreement of performance

(iii) the extent of dissatisfaction and

(iv) the extent of supplier recognition of a performance gap

The upstream relationships between the manufacturers and the area distributors appeared to be fraught with problems of misperception about what was required and what performance was (i.e. greater type 1 and type 2 mismatches). They also exhibited substantially more customer dissatisfaction (type 3 mismatch).

The difference between the amount of customer dissatisfaction and the suppliers' recognition of a performance gap appeared to be greater upstream i.e. there appeared less likelihood that this performance gap would be closed. The more harmonious relationships and the better performing relationships appeared to be those closest to the end customer, downstream in the supply chains. Possible reasons for this are discussed later in Chapters 12 and 13.

The qualitative analysis indicated a possible trend in the data which can be further explored quantitatively; this is performed in the next chapter on quantitative analysis.

These observations are particularly prone to subjectivity because the qualitative data being handled is unwieldy to manage. Therefore further analysis relating to the type of mismatch is performed in the next chapter on quantitative analysis.

CONCLUSIONS

This section draws together the conclusions from the different steps of qualitative analysis performed.

Conclusions of the analysis within the dyads

The qualitative analysis within the dyads identified the gaps between customers' and suppliers' perceptions of requirements and performance. It enabled comments to be made on 4 types of mismatch against 5 different performance dimensions.

These comments provided a rich picture of requirements and performance in each of the performance dimensions. They also provided the basis for making comparisons between performance dimensions, type of mismatch, dyads, chains, territories, product types and dyadic levels.

Conclusions of the cross dyad comparisons

It was observed that one particular dyadic relationship appeared significantly more harmonious and satisfied than others. There were several relationships which appeared

to be sour and dissatisfied. The next chapter will test if these differences are significant.

Conclusions of the cross performance dimension comparisons

It was concluded that delivery was the focus of more customer dissatisfaction than any other performance dimension. Customers were also noticeably dissatisfied with service and range but less so with quality and hardly at all with price. It appeared that suppliers were generally quite aware of delivery problems but did not appear to perceive them as anywhere near as great as did the customers in the relationships.

A clear picture could not be drawn from the qualitative data whether misperceptions of requirements and performance were substantially greater for any one dimension than for any other.

Conclusions of the cross mismatch type comparisons

It was concluded that there appeared to be more misperceptions of performance than of requirements. Additionally it appeared that customers perceived larger gaps between their requirements and the performance they received than did the suppliers in the relationships.

Conclusions of the cross chain qualitative comparisons

The cross chain comparisons made observations on how the UK braking chain appeared different to the other 3 chains in terms of:

(i) The extent of misperception regarding performance, compared to misperception regarding requirements

(ii) The amount of customer dissatisfaction, though it was identified that all chains exhibited customer dissatisfaction so this difference should be further tested for significance

(iii) The degree of supplier complacency relative to the amount of customer dissatisfaction, though again this difference should be further tested for significance

It appeared, therefore, that some differences between the chains did exist; although they did not appear great, they should be tested for significance to see if differences between the supply chains studied could be affecting the results.

Conclusions of the cross territory qualitative comparisons

It was concluded that, despite observed differences between the Spanish and UK territories relating to:

(i) Requirement for Original Equipment parts

(ii) Service requirements

(iii) Range requirements

that there was no apparent significant difference between the two territories as far as customer satisfaction / dissatisfaction was concerned. There was some apparent difference in the suppliers' recognition of problems, however, between the territories. It appeared from the data that the Spanish chains had a clearer understanding about what was required and the UK chains were slightly more complacent than their Spanish equivalents. However, both chains appeared to be equally confused about performance.

On reflection it was concluded that these differences between the territories did not appear significant but that this should be further tested.

Conclusions of cross product comparisons

It was concluded that the quantitative analysis did not reveal any significant differences between the braking and electrical product supply chains but that this should be further tested.

Cross dyadic level comparisons

From the qualitative analysis there did appear to be substantial differences in the data gathered in the dyads closer to the customer end of the chain i.e. the INS/LD

dyads compared to those further upstream. It was concluded that customer dissatisfaction appeared greater further upstream as did the extent of misperceptions. Also it was concluded that the upstream suppliers were less likely to be motivated to improve performance as they perceived the performance gap to be less than their customers. It was concluded that this should be further tested.

The qualitative analysis allowed consideration of the data at the level of individual comments made and flagged up differences between groupings of data when comparisons were made. This presents an opportunity to explore this data further with more objective, rational, quantitative analysis to tackle the multi-variable comparisons which may help to prove the hypotheses more conclusively. This quantitative analysis is performed in the next chapter.

CHAPTER 11 - QUANTITATIVE ANALYSIS OF RESULTS

SUMMARY

This chapter presents the quantified data results in the form of a Likert scores table; the data is analysed using frequency analysis, graphs, Tukey tests for multi-variable comparison and correlation.

The results of this quantitative analysis show:
(i) Customers recognise significantly greater performance gaps than do suppliers in the relationships studied
(ii) Customer dissatisfaction is not correlated to misperception of requirements.
(iii) Customer dissatisfaction is positively correlated to misperception of performance.
(iv) Both the above correlation results hold true when the data is standardised to remove influencing effects
(v) Both customer dissatisfaction and misperceptions about performance significantly increase upstream
(vi) Customers are significantly more dissatisfied with delivery performance than with price performance in the relationships

The results of this chapter will not be viewed independently, but rather will be combined with the qualitative results from the previous chapter when considering the testing of hypotheses in the next chapter.

INTRODUCTION

This chapter provides quantified results in the form of a Likert scores table and uses the methodology for sequence of quantitative analysis given in that chapter 9 and provided again below in figure 11.1.

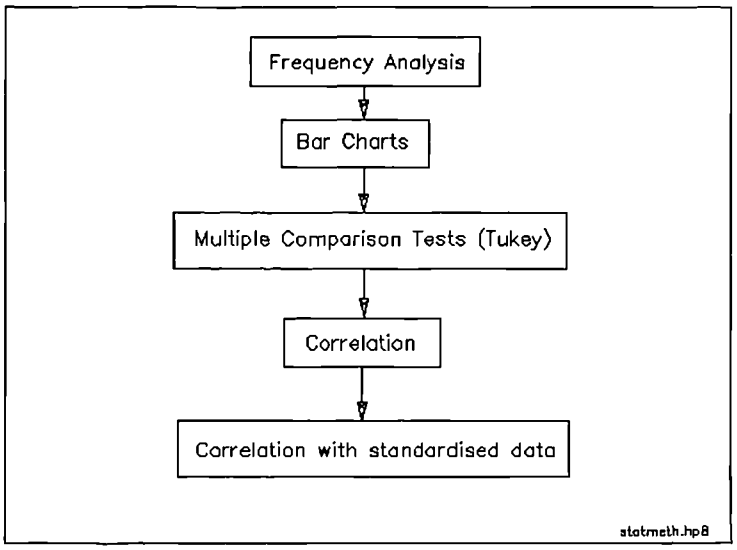

Figure 11.1: Sequence for Quantitative Analysis of Results

To reiterate, the data was gathered using the mismatch model shown below in figure 11.2:

The extent of differences of each type of mismatch are aggregated showing that differences in perceptions of customer requirements existed (T1 mismatch) and differences in perceptions of supplier performance existed (T2 mismatch); these 2 types of mismatch were termed **misperceptions.** Gaps between customers requirements and their perceptions of performance (T3 mismatch) existed; these were termed **customer dissatisfaction.** Gaps between suppliers' perceptions of

customer requirements and their own performance (T4 mismatch) were termed **supplier recognition of performance gaps.**

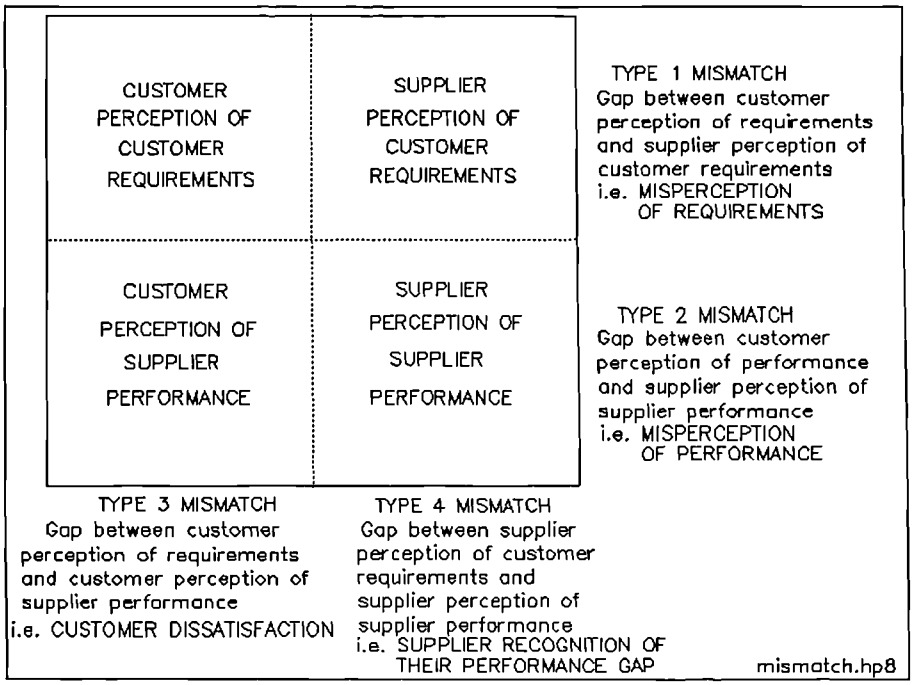

Figure 11.2: Mismatch model

The core of this research is to identify patterns in the supply chains studied of these types of mismatch. The qualitative analysis in the previous chapter identified that differences appeared to exist between the types of mismatch. This next section analyses the data quantitatively, slicing it by type of mismatch, to identify if this quantitative evidence appears to suggest the existence of these differences and, beyond that, if they are statistically significant.

Firstly the scores table and validation of that table is described here.

THE SCORES TABLE

The qualitative data in the mismatch tables was quantified by assigning scores corresponding to the semantic differential Likert scale presented in chapter 9, shown below:

0	Harmony of views
1	Slight difference in views
2	Moderate difference in views
3	Substantial difference in views
4	Very substantial difference in views
5	Polarity of views

Table 11.1: Likert scale used for scoring mismatches

The example below shows a mismatch table for the range dimension for the UK Braking Chain with the allocated scores added.

LOCAL DISTRIBUTOR'S VIEW OF RANGE REQUIREMENTS	AREA DISTRIBUTOR'S VIEW OF RANGE REQUIREMENTS	TYPE ONE MISMATCHES
The Local Distributor doesn't want suppliers to cover every specialism; they wouldn't place more than 15% of their spend with any one supplier, even if they offered the range, because of their fear of dependence. They would rather have range depth within the range from suppliers, rather than range breadth.	The Local Distributor wants a wide range and an all makes programme.	Very substantial difference in perspective as the Local Distributor claims to want depth not breadth from its suppliers. It doesn't want to be reliant on any one supplier. **Score of 4 allocated.**
LOCAL DISTRIBUTOR'S VIEW OF RANGE PERFORMANCE	**AREA DISTRIBUTOR'S VIEW OF RANGE PERFORMANCE**	**TYPE TWO MISMATCHES**
Range is pretty good but there are some holw. The Area Distributor works hard on their range.	Our range is much wider than other component suppliers	Slight difference as the Local Distributor perceives some holes. **Score of 1 allocated**
TYPE THREE MISMATCHES	**TYPE FOUR MISMATCHES**	
Slight difference. **Score of 1 allocated**	No mismatch. **Score of 0 allocated**	

Table 11.2 Example of a mismatch table showing scores

The assignment of scores lead to the production of the scores table shown below in table 11.3.

To validate the scores table, the assistance of a friend and colleague - Lin Fitzgerald - was used. Lin is a full time lecturer at Warwick Business School in the Accounting and Finance group. She is a cost accountant by background whose specialist research area is performance measurement in service industries.

LEVEL		UK BRAKING				SPAIN BRAKING				UK ELECTRICAL				SPAIN ELECTRICAL			
		T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
INSTALLER/ LOCAL DISTRIBUTOR	Q	2	2	2	0	2	1	1	0	1	1	1	0	4	1	1	3
	D	3	4	4	0	0	0	1	1	0	3	2	1	0	0	2	3
	S	4	4	2	0	0	0	0	0	1	0	0	0	3	3	3	0
	R	1	2	2	1	0	1	3	3	3	0	3	4	2	0	4	4
	P	0	2	1	2	0	0	0	0	3	1	1	1	0	1	0	1
LOCAL DISTRIBUTOR/ AREA DISTRIBUTOR	Q	0	0	2	2	0	1	0	1	2	2	3	2	4	4	4	1
	D	2	0	4	4	0	3	2	0	0	0	3	4	0	3	3	1
	S	0	2	4	3	2	3	3	3	0	0	0	0	2	3	3	2
	R	4	1	1	0	2	4	4	0	2	2	3	0	3	3	3	0
	P	0	2	2	1	0	2	2	0	3	3	3	0	0	0	0	0
AREA DISTRIBUTOR/ MANUFACTURER	Q	2	2	2	0	3	3	0	3	3	2	0	2	1	1	4	3
	D	3	4	5	1	4	4	4	0	2	0	5	5	0	0	3	3
	S	0	4	4	0	3	4	4	3	0	3	5	3	4	3	0	4
	R	0	3	3	1	3	3	3	2	3	3	3	0	3	2	3	3
	P	0	3	0	3	2	0	4	0	3	3	3	0	3	3	1	1

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Table 11.3: Scores table

Being part of the ESPRIT project team, Lin was actively involved at the start of the research to generate a methodology to analyse supply chain processes. However,

due to extended illness, she was not involved in the data collection or the subsequent analysis of that data. Therefore, she possessed the required knowledge of the supply chains and the definitions of performance being used, but was not biased by any involvement in analysing that performance. She therefore satisfied the required criteria of a validator, identified in chapter 9.

Lin was provided with the textual data on customer and supplier perceptions on requirements and performance in the four supply chains. This data was categorised by supply chain, then by dyadic level, then by operational priority, then by perceptions of requirements or performance before she was given it.

To validate the results Lin assessed the extent of the mismatches of Types 1-4, allocating a score from the semantic differential scale provided to her. This validation work was performed on two whole chains - the UK Braking Chain and the Spanish Braking Chain. The resulting scores allocated by her are provided in the scores table below.

LEVEL		UK BRAKING T1	T2	T3	T4	SPAIN BRAKING T1	T2	T3	T4
INSTALLER/ LOCAL DISTRIBUTOR	Q	2	2	1	0	1	1	1	0
	D	4	4	4	0	0	0	0	0
	S	4	4	2	0	0	0	0	0
	R	1	1	1	1	0	1	2	3
	P	0	2	1	2	0	0	0	0
LOCAL DISTRIBUTOR/ AREA DISTRIBUTOR	Q	0	0	1	1	0	0	0	0
	D	1	0	4	4	0	3	1	0
	S	0	3	4	4	1	3	3	4
	R	4	1	1	0	2	4	3	0
	P	0	2	1	1	0	2	2	0
AREA DISTRIBUTOR/ MANUFACTURER	Q	1	2	2	0	3	3	0	1
	D	3	4	4	1	4	4	4	0
	S	0	4	4	0	3	4	4	4
	R	0	3	3	1	3	3	3	1
	P	0	2	0	3	1	0	3	0

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Table 11.4: Table showing scores allocated during validation

To analyse the differences between Lin's scores in the above table and my scores given in the previous scores table in table 11.3, firstly a frequency table of differences between the scores was drawn up, as shown below in table 11.5.

Difference	Score	Proportion
0	91	0.758
1	28	0.233
2	1	0.009

Table 11.5: Frequency table showing difference between validating score and original score

Table 11.5 above shows that nearly 76% of the validated scores were marked the same as the scores in this study.

Less than 1% (one score) was marked more than 1 score away on the semantic differential scale.

Applying Pearson's correlation coefficient to identify how closely correlated the 2 sets of data are, gives a value of r = 0.9448 which is significant at the 0.1% level.

However, significant correlation does not guarantee that the scores were the same absolute values. The frequency analysis showed that just under 76% of the scores were the same absolute values but is this significant? To ascertain this, a confidence interval on the proportion of scores marked the same was calculated using the following formula:

$$p +/- z \frac{p(1-p)}{n}$$

For 95% confidence limit, z is 1.96 which gives:

$$0.758 +/- 1.96 \frac{0.758(1-0.758)}{120}$$

$$=> 0.758 +/- 0.077$$

i.e. one can be 95% confident that the proportion of validation scores that are identical with the original scores lies in the range of 68.1% - 83.5%. Therefore for

subjectively assigned data using a semantic differential scale, the validation appears to support the original data.

Having generated a validated scores table, the next sections analyse that data quantitatively. The first step in this analysis is to identify the level of scores of different types of mismatch.

TOTALS OF TYPES OF MISMATCH

Firstly a frequency table of scores for each type of mismatch was produced and is provided below in table 11.6[1].

1 The right hand column fx is derived from multiplying the frequency of the incidence of the score (f) from the body of the table by the score (x) at the top of the table.

	SCORE x						
	0	1	2	3	4	5	SUM fx
MISMATCH							
Type 1	23	4	12	15	6	0	97
Type 2	15	8	11	18	8	0	116
Type 3	11	8	10	17	11	3	138
Type 4	24	12	6	12	5	1	85

Table 11.6: Frequency table for scores of mismatch type

Table 11.6 shows that differences are evident between the extent of each type of mismatch. These are clearer in the graph below.

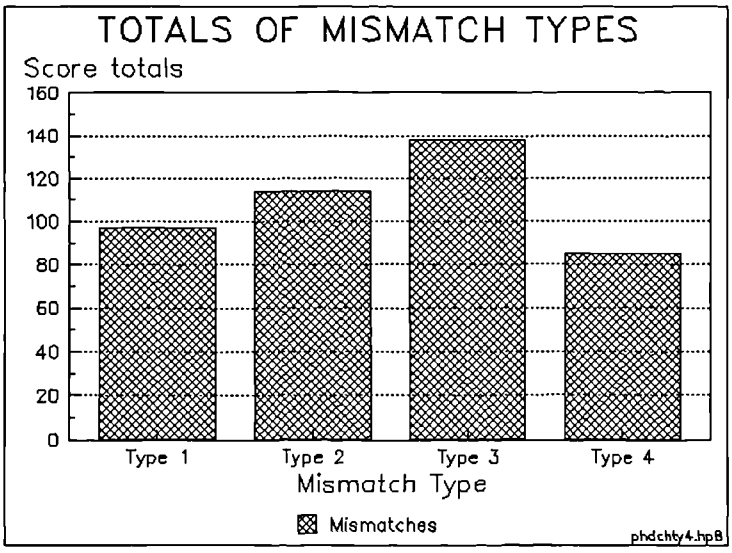


Figure 11.3: Graph showing total scores of different types of mismatch.

It is apparent from figure 11.3 that the scores for customer dissatisfaction (T3) are higher than the others. Of particular interest is that, in contrast, the suppliers' recognition of gaps (T4) scores the lowest

total mismatches. This indicates that the suppliers in the relationships are not aware of the extent of customer dissatisfaction and may be viewing their performance in the relationships in an unjustifiably favourable light.

In order to see if any of these differences are significant, as is indicated in the flow chart in figure 11.1, the next step is to do a multiple comparison or Tukey Test. A worked example of this first Tukey test is provided in Appendix 3.

The results of the Tukey test show that customer dissatisfaction (T3) is significantly greater (at the 1% level) than the suppliers' recognition of a gap between performance and requirements (T4). None of the other total mismatch scores are significantly greater than any other.

This significant difference between customers' views and suppliers' views of the performance / requirements gap will be discussed further in the following chapter.

The next sections take each type of mismatch and make comparisons of their incidence across performance dimension, dyad, chain, territory, product type, and dyadic level.

ANALYSIS OF MISPERCEPTIONS OF CUSTOMERS' REQUIREMENTS (T1 MISMATCHES)

A type 1 mismatch represents a misperception of a customer's requirements i.e. the gap between what a customer says they require and what a supplier thinks that customer requires.

The frequency table shown below in table 11.7 shows the extent of misperception of requirements (Type 1 mismatch) in the relationships studied.

Score x	Frequency f	fx
0	23	0
1	4	4
2	12	24
3	15	45
4	6	24
5	0	0
	60	97

Mean = 97/60 = 1.617

Table 11.7: Frequency table showing mean of scores for misperception of customer requirements (T1)

Using the differential semantic scale previously provided, this mean score corresponds to an average of slight to moderate difference in views.

Having identified that slight to moderate differences in views exist, the following sections examine if these differences are significantly different between:

(i) Performance dimensions of quality, delivery, service, range and price

(ii) The two sample territories of UK and Spain

(iii) The two sample product groups of braking and electrical products

(iv) The four sample supply chains studied

(v) The 12 customer / supplier dyads studied i.e. for each of the four chains the relationships of Manufacturer / Area Distributor, Area Distributor / Local Distributor and Local Distributor / Installer Group.

(vi) The 3 dyadic levels studied i.e. all the relationships at the level of Manufacturer / Area Distributor, those at Area Distributor / Local Distributor and those at Local Distributor / Installer Group.

To analyse each of the above, graphs will be presented showing visual differences between the variables then Tukey tests will be used to perform multiple comparisons.

Differences in misperception of requirements (T1 mismatch) by performance dimension

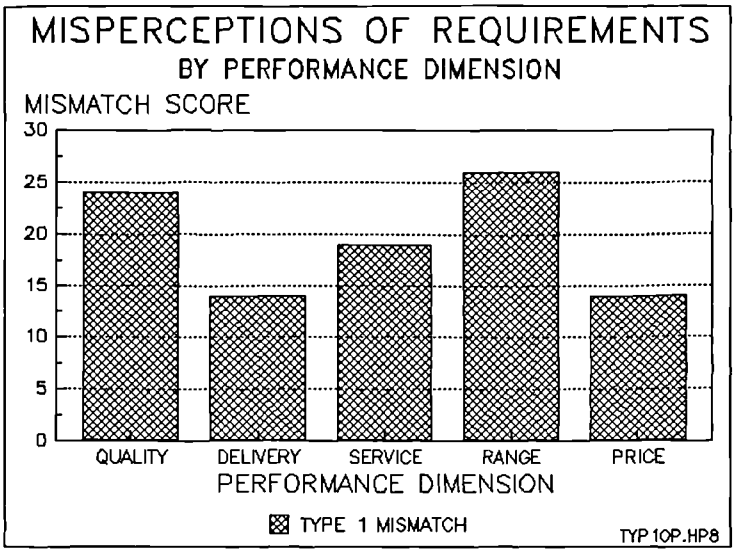


Figure 11.4: Graph showing differences in misperception of requirements by performance dimension

The graph above shows some differences in misperception of customer requirements between performance dimensions. From the quantification of mismatches in views there appears to be more misperception relating to customer requirements for range and quality than to price or delivery.

To identify if the differences are significant, a Tukey test was performed on the differences in sample means. These differences were shown not to be statistically significant.

Differences in misperception of requirements by territory

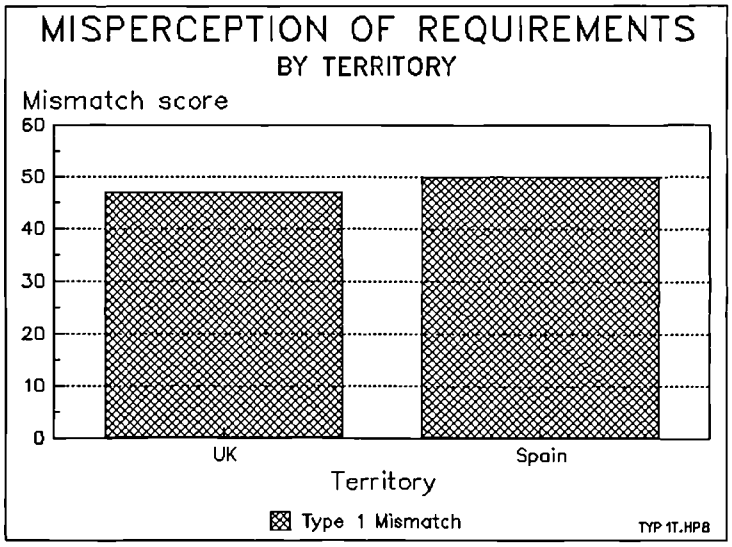


Figure 11.5: Graph showing differences in misperception of requirements by territory

The above graph showed little visual difference between the Spanish and UK levels of misperception of requirements. A Tukey test showed this difference not to be significant.

Differences in misperception of requirements by product

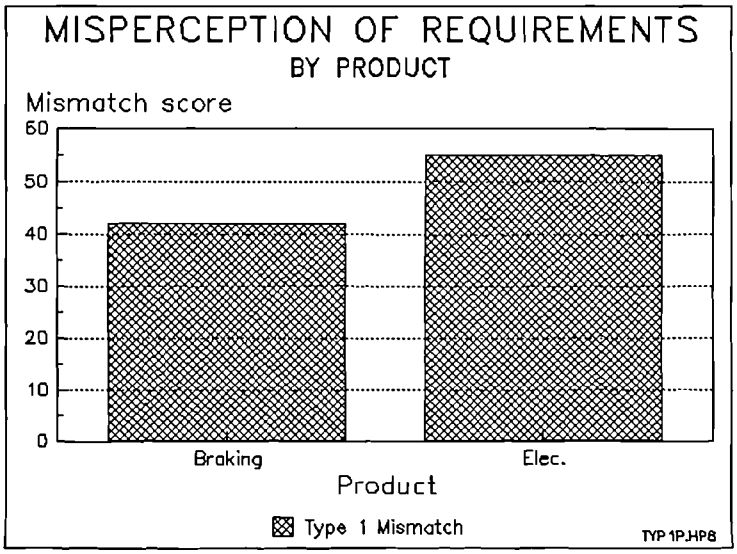


Figure 11.6: Graph showing differences in misperception of requirements by product

The chains supplying electrical products exhibited higher levels of misperception of requirements than the dyads in chains supplying braking products. However, the results of a Tukey test showed that no statistically significant difference existed between the misperception of requirements exhibited by product type.

Differences in misperception of requirements by chain

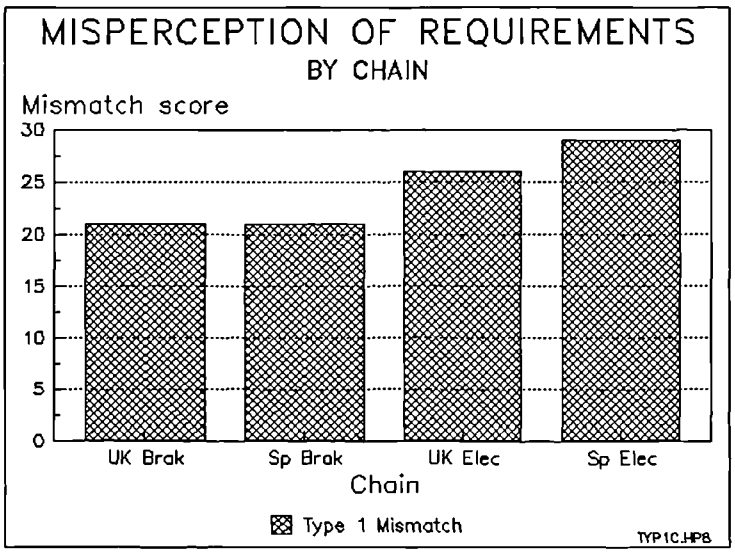
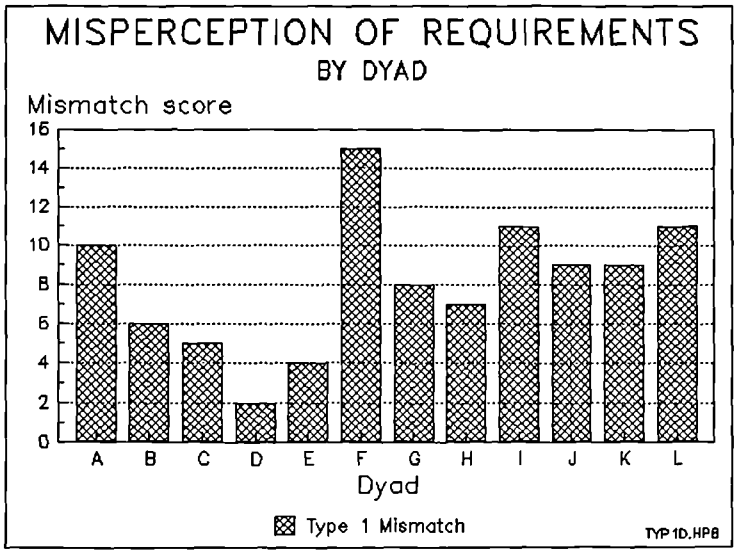


Figure 11.7: Graph showing differences in misperception of requirements by chain

The differences in misperceptions of requirements by product type highlighted in the previous section is reinforced when the four separate chains are considered. It can be seen in the graph above that the Spanish electrical chain exhibited greater levels of Type 1 mismatch than did the other chains, with the UK electrical chain showing the second highest score.

The results of a Tukey test on the differences showed them not to be statistically significant.

Differences in misperception of requirements by dyad



Key:	A	-	INS/LD dyad	-	UK braking chain
	B	-	LD/AD dyad	-	"
	C	-	AD/M dyad	-	"
	D	-	INS/LD dyad	-	Spanish braking chain
	E	-	LD/AD dyad	-	"
	F	-	AD/M dyad	-	"
	G	-	INS/LD dyad	-	UK electrical chain
	H	-	LD/AD dyad	-	"
	I	-	AD/M dyad	-	"
	J	-	INS/LD dyad	-	Spanish elect. chain
	K	-	LD/AD dyad	-	"
	L	-	AD/M dyad	-	"

Figure 11.8: Graph showing differences in misperception of requirements by dyad

Each of the 12 relationships studied showed varied levels of score of misperception of requirements. Visually there appears to be a great difference between the Type 1 mismatch scores of, for example, dyad D compared to dyad F. However, a Tukey test shows these differences not to be statistically significant. This may seem surprising, faced with the graph above which shows apparent

differences. However, this highlights the strength of F-tests and their derivatives in preventing a Type I error i.e. rejecting the null hypothesis that there is no difference. These particular tests recognise that with larger numbers of multiple comparisons, statistically there is likely to be a wide variation in scores because of sample error alone. Certainly, had statistical analysis not been performed, different conclusions may have been drawn from the graphs.

Differences in misperception of requirements by dyadic level

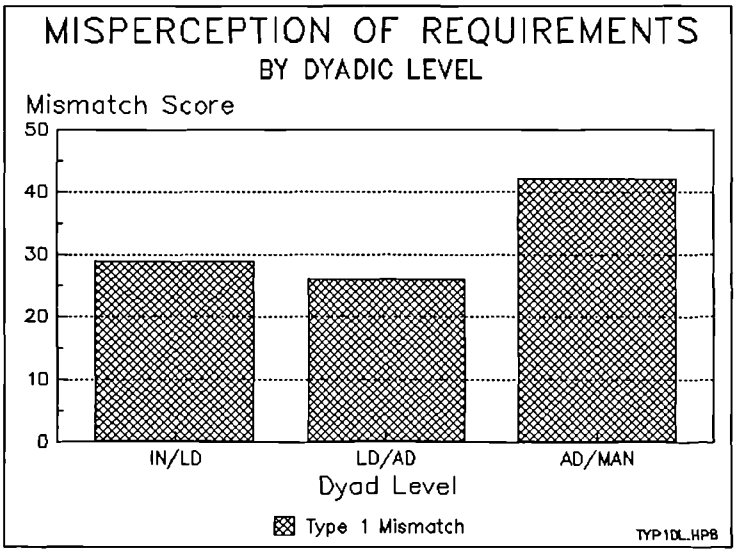


Figure 11.9: Graph showing differences in misperception of requirements by dyadic level

Whilst the graph shows that the dyadic level of Area Distributor / Manufacturer exhibited higher scores for total mismatch of perception of requirements, there is no apparent increasing trend by level.

The differences in the data aggregated at the dyadic level were shown not to be significant by Tukey tests.

ANALYSIS OF MISPERCEPTION OF PERFORMANCE (T2 MISMATCHES)

To give an initial indication of the extent of misperceptions about performance a frequency table of mismatch scores showing differences between customers' views of supplier performance and suppliers' views of their own performance (i.e. Type 2 mismatch) can be considered.

Score x	Frequency f	fx
0	15	0
1	8	8
2	11	22
3	18	54
4	8	32
5	0	0
	60	116

Mean = 116/60 = 1.933

Table 11.8: Frequency table showing mean of scores for misperception of supplier performance

The mean score lies in the category of slight to moderate differences between views of performance, using the semantic differential scale provided previously. Having identified that some misperception of performance exists in the relationships studied, the following sections analyse these misperceptions further to identify if they occur uniformly or otherwise across different performance dimensions, different territories, different products,

different supply chains, different dyads studied and also different dyadic levels.

Differences in misperception of performance between performance dimensions

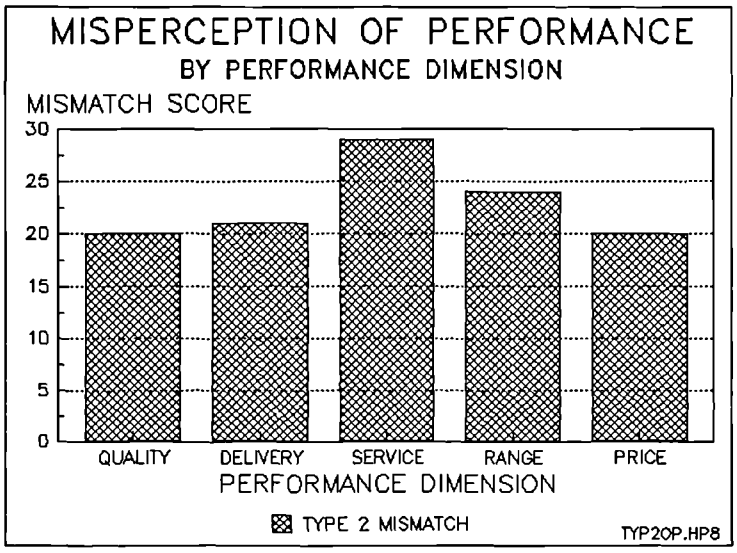


Figure 11.10: Graph showing differences in misperceptions by performance dimensions

There appears to be greater misperception relating to views on supplier performance relating to service and range than to price and quality.

Tukey tests were performed which showed the differences in the data not to be statistically significant.

Differences in misperception of performance between territories

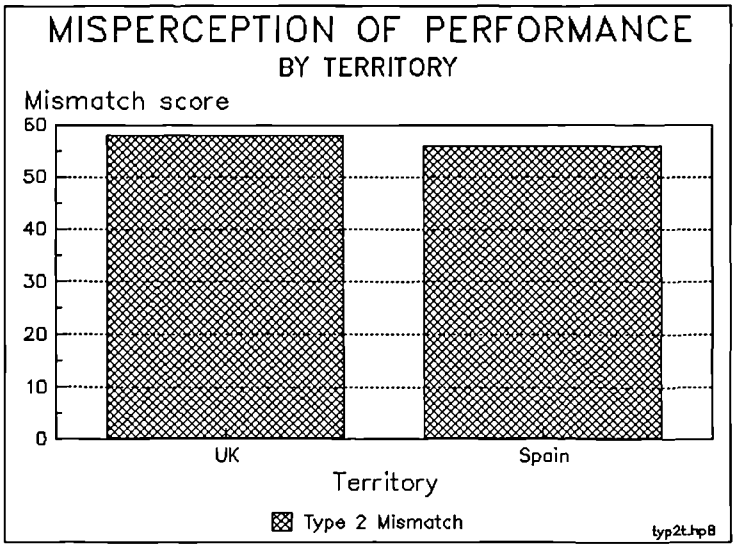


Figure 11.11: Graph showing differences in misperception of performance by territory

The above graph shows that there appears to be very little difference between the amount of misperception of performance in the Spanish chains compared to the UK chains. A Tukey test supported this visual comparison, showing the difference not to be statistically significant.

Differences in misperception of performance between products

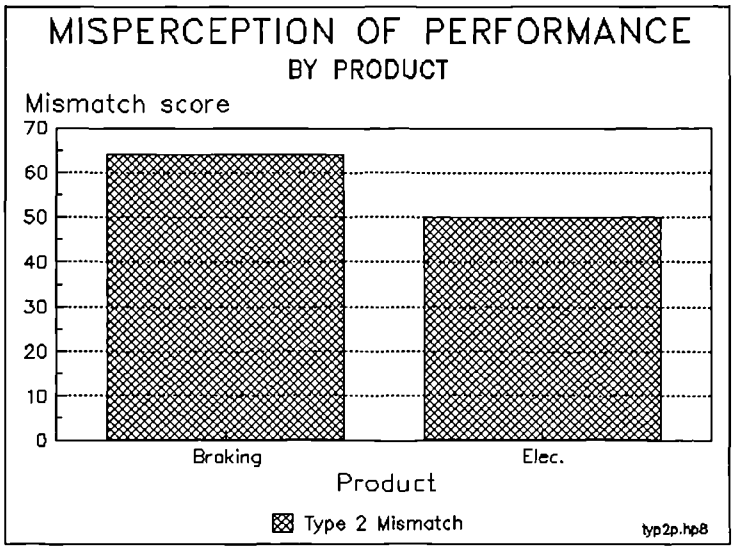


Figure 11.12: Graph showing differences in misperception of performance between products

The above graph shows slightly more misperception in the braking chains compared to the electrical chains. Though slight, this is different to the comparison of scores for misperception of requirements discussed previously, which showed more misperception in the electrical chains. i.e. the relationships in the electrical chains appear to contain more misperception about what is required whereas the relationships in the braking chains appear to contain more misperception about what actually happens.

The above differences were tested for statistical significance using a Tukey test which showed them not to be significant.

Differences in misperception of performance between chains

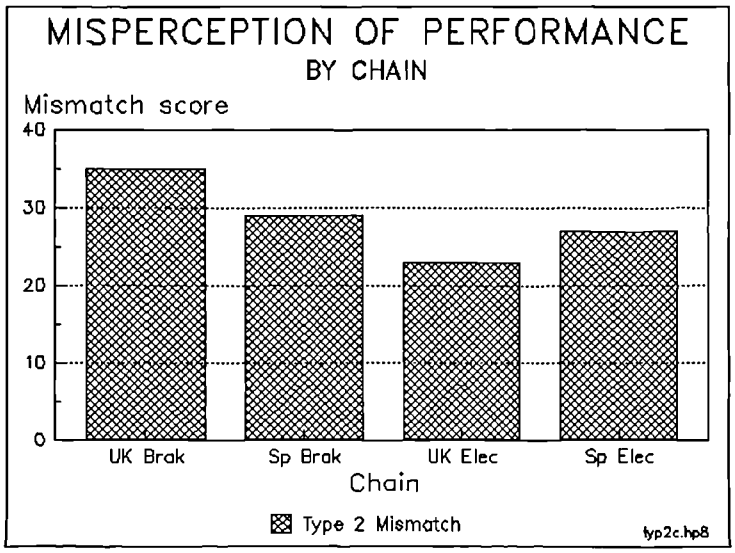


Figure 11.13: Graph showing misperceptions in each of the four chains studied

The graph above shows that the UK braking chain contains more misperception about performance than the other chains. This is again in contrast to the data collected about misperception of requirements.

Testing for statistically significant differences showed that none of the differences between misperceptions of performance were significant.

Differences in misperception of performance between dyads

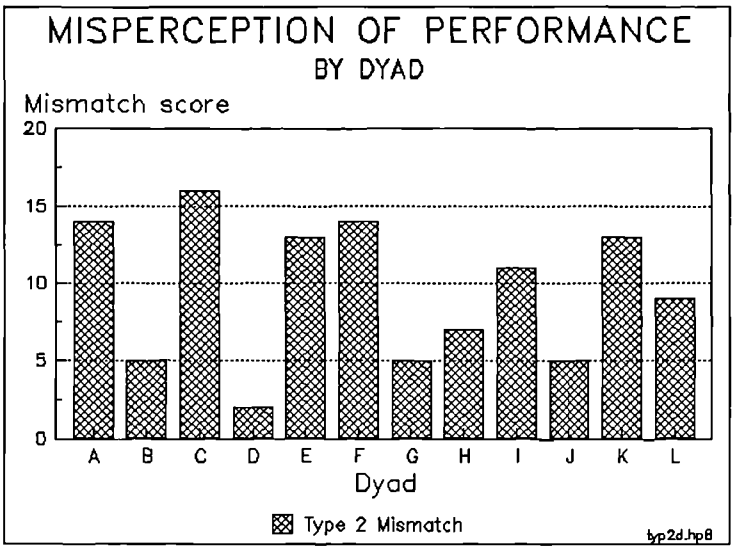


Figure 11.14: Graph showing differences in misperception of performance between dyads

Visual examination of the scores shown in the above graph shows that dyad D has a low score of misperception of performance when compared to other dyads such as C, A and F.

A Tukey test for multiple comparison showed that the score for dyad D was significantly greater than that for dyad C. Possible reasons for this difference are discussed in the next chapter. Any differences between other dyads' levels of misperception of performance were not statistically significant.

Differences in misperception of performance by dyadic level

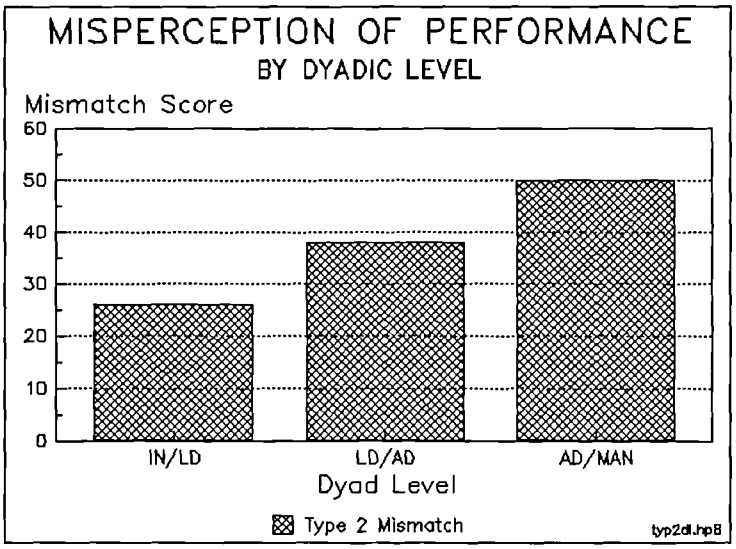


Figure 11.15: Graph showing differences in misperception of performance between dyadic levels

As can be seen in the graph above, the scores for misperceptions of performance increase up the supply chain.

Tukey tests on these scores show that, whilst the difference between each individual level i.e. IN/LD to LD/AD and LD/AD to AD/MAN, are not statistically significant, the difference between IN/LD and AD/MAN is significant at the 5% level.

This shows that there is more misperception about performance in the relationships upstream when compared to the relationships downstream. This phenomenon is discussed in more detail in the next chapter.

ANALYSIS OF CUSTOMER DISSATISFACTION (T3 MISMATCHES)

To re-iterate, customer dissatisfaction is defined in this research as the gap between customers' expressed views of their requirements and their perception of supplier performance.

To assess the extent of customer dissatisfaction, a frequency table of Type 3 Mismatch scores can be considered i.e. those scores showing the gap between customers' requirements and their perception of performance.

Score x	Frequency f	fx
0	11	0
1	8	8
2	10	20
3	17	51
4	11	44
5	3	15
	60	138

Mean = 138/60 = 2.3

Table 11.9: Frequency table showing customer dissatisfaction scores

As can be seen in the above frequency table, the mean score of customer dissatisfaction = 2.3.

Using the semantic differential scale provided in the previous chapter, it can be seen that the mean score lies between the categories of moderate and substantial mismatch in views.

The following sections analyse the customer dissatisfaction data to identify if dissatisfaction occurs equally or not across performance dimensions, territories, product type, supply chain, dyad and dyadic level.

Customer dissatisfaction by performance dimension

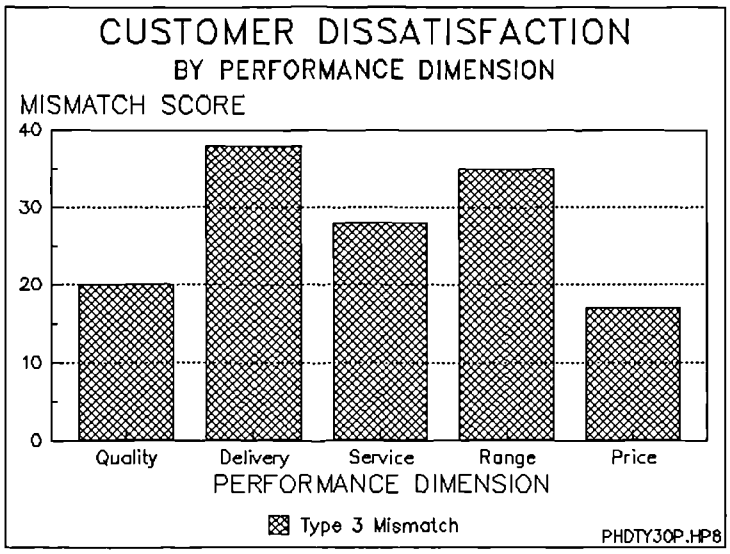


Figure 11.16: Graph showing occurrence of customer dissatisfaction by performance dimension

The graph above shows that customers are more dissatisfied with delivery and then range issues and appear to be less dissatisfied with price.

Using a Tukey test The difference between customer dissatisfaction with delivery and with price was shown to statistically significant. The other differences in means when comparing, for example, delivery and quality, or range and price, were not significantly different.

Customers in the supply chains studied are clearly dissatisfied with aspects of delivery performance. Possible reasons for this dissatisfaction are explored in the next chapter.

Dissatisfaction differences by territory

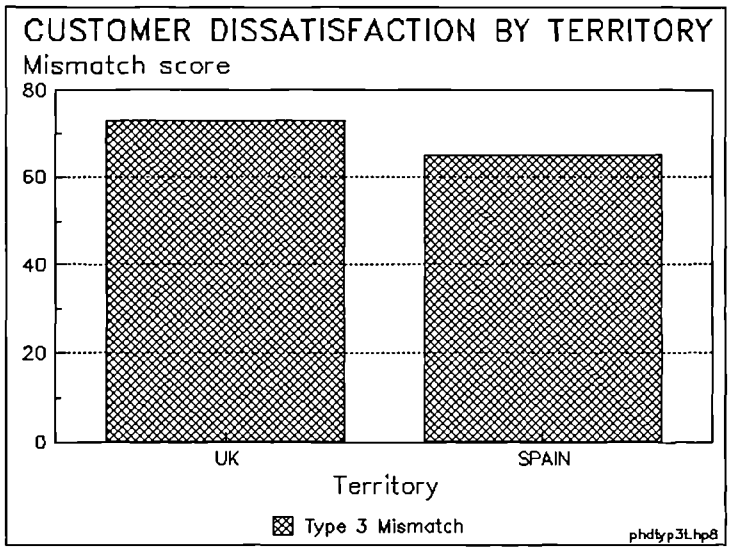


Figure 11.17: Graph showing customer dissatisfaction by territory

The graph indicates that customers in the UK chains are slightly more dissatisfied than those in the Spanish chains. A Tukey test for any statistically significant difference showed that one didn't exist.

Comparing this to some of the qualitative comparisons made in chapter 10 shows some interesting differences; this comparison takes place in the next chapter.

Dissatisfaction differences by product

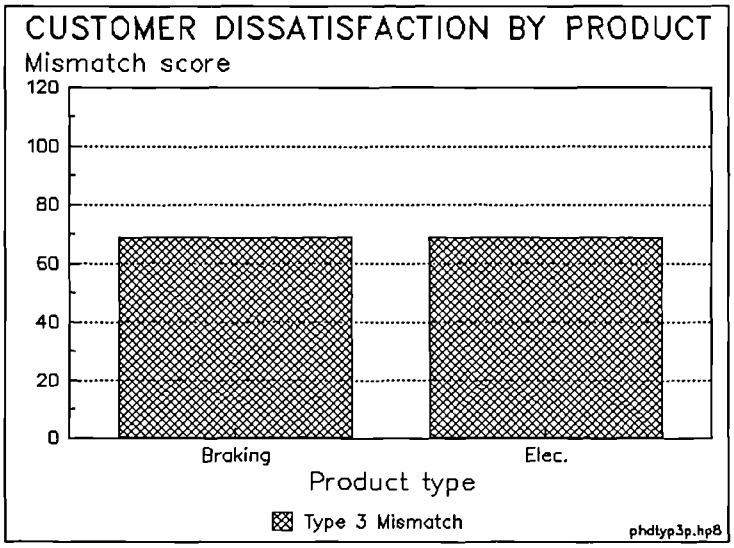


Figure 11.18: Graph showing extent of customer dissatisfaction by product

The graph above shows an identical level of customer dissatisfaction in the braking chains when compared to the electrical chains; a Tukey test supported that no significant difference existed when comparing product groups.

Dissatisfaction differences by chain selected

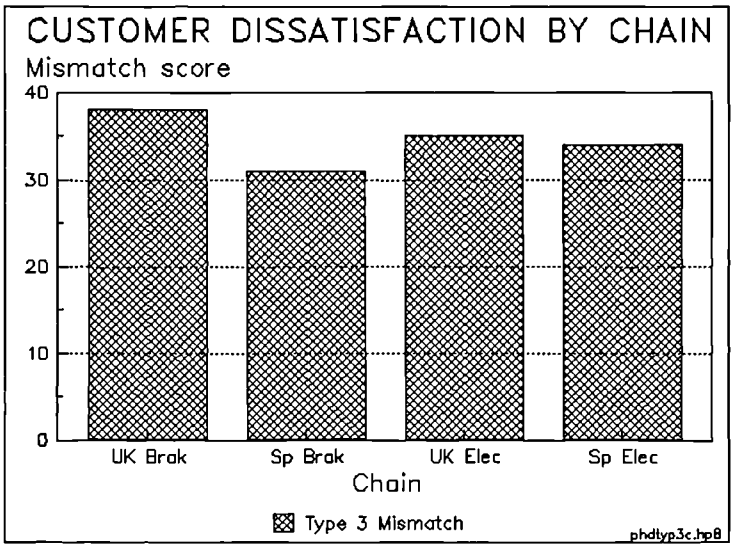


Figure 11.19: Graph showing extent of customer dissatisfaction by chain

The above graph comparing customer dissatisfaction in the four chains studied showed greater dissatisfaction in the UK braking chain. It should be noted that this is the same chain as exhibited the greatest score for misperception of performance. The relationship between disagreement on performance and customer dissatisfaction is explored later.

A Tukey test showed the differences between chains not to be statistically significant.

Dissatisfaction difference by dyad

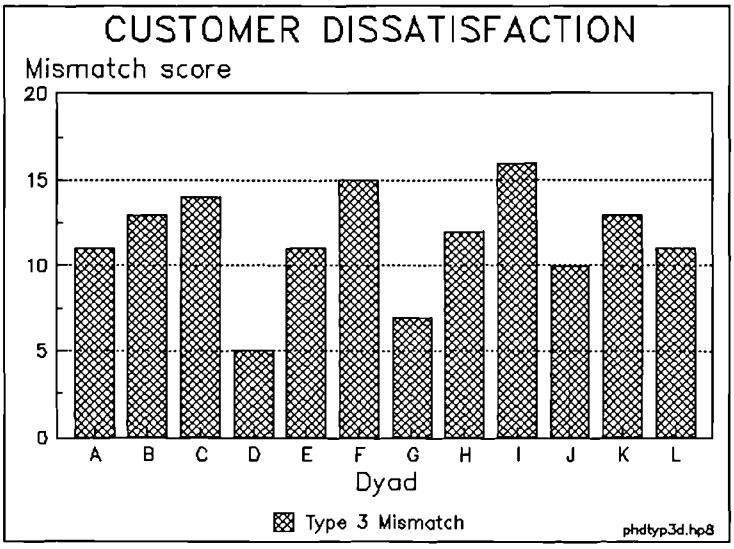


Figure 11.20: Graph showing extent of customer dissatisfaction by dyad

It can be seen in the above graph that there are variable levels of customer dissatisfaction in the different dyads studied. The customer in Dyad D appears to be less dissatisfied than do the customers in dyads I or F, for example. In the next chapter some possible reasons for these different levels of dissatisfaction are explored.

Having applied a Tukey test, it was shown that these differences were not statistically significant.

Differences in dissatisfaction by dyadic level

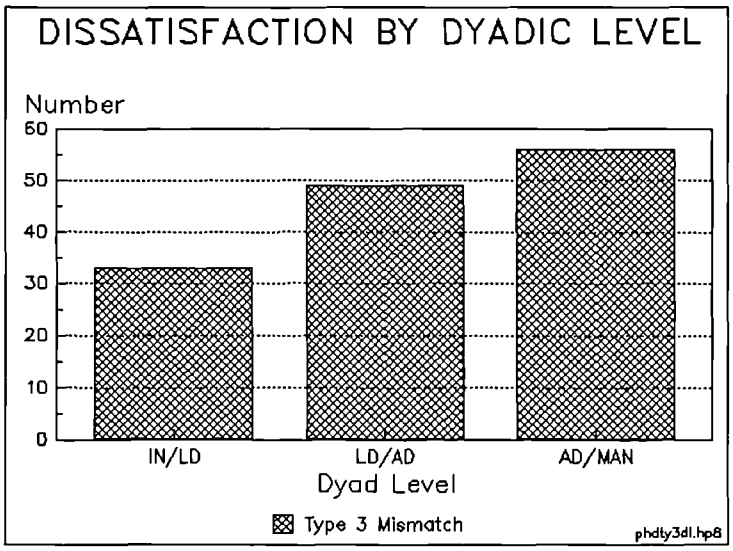


Figure 11.21 Graph showing levels of customer dissatisfaction by dyadic level

It can be seen in the above graph that customer dissatisfaction increases further upstream. Using a Tukey test the differences between the INS / LD & LD/AD dyadic levels and the LD/AD and AD/M levels were shown not to be significant. However, the difference between the INS/LD and AD/M levels are statistically significant.

ANALYSIS OF SUPPLIER RECOGNITION OF PERFORMANCE GAP (T4 MISMATCHES)

Mismatch type 4 scores show if suppliers recognise any gap between their perceptions of customer requirements and their perceptions of their own performance.

Score	Frequency	fx
0	24	0
1	12	12
2	6	12
3	12	36
4	5	20
5	1	5
	60	85

Mean = 85/60 = 1.417

Table 11.10: Frequency table showing incidence of scores for supplier gap recognition i.e. T4

It can be seen from the above frequency table that gaps between suppliers' perception of their performance and their perception of customers' requirements do exist. Using the same semantic differential scale used earlier, the mean score of these gaps lies between slight to moderate differences on this scale.

Having identified that some recognition of performance gap existed with suppliers, the following sections identify if this recognition differs across performance dimensions, territories, products, supply chains, dyads and dyadic levels.

Differences in supplier gap recognition by performance dimension

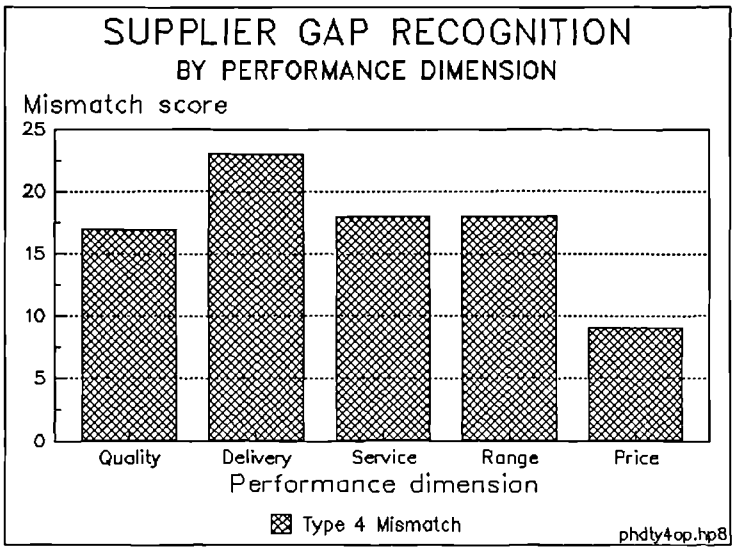


Figure 11.22: Graph showing differences in supplier gap recognition by performance dimension (T4)

From the above graph it appears that there is more recognition of gaps between suppliers' perception of their performance and their perception of customer requirements related to delivery than to price, in particular.

To identify if this difference is significant, a Tukey test was performed; this showed the differences not to be statistically significant.

When comparing the type 4 mismatch data with the type 3 mismatch data, some similarities and differences in the two patterns are evident.

(i) Customers and suppliers both recognise that the most performance problems are associated with delivery

(ii) Both customers and suppliers associate less problems with price performance than any other performance dimension

(iii) Suppliers do not distinguish much difference between levels of performance problems relating to service, range and quality. However, customers in the relationships appear to be far more aware of a performance gap over range issues than over quality issues

(iv) The range of differences of mismatch scores between performance dimension factors is much greater from the customers' perspective (T3 scores) when compared to the suppliers' perspective (T4) indicating that customers appear to be differentiating more than suppliers do between these factors.

Differences in supplier gap recognition by territory

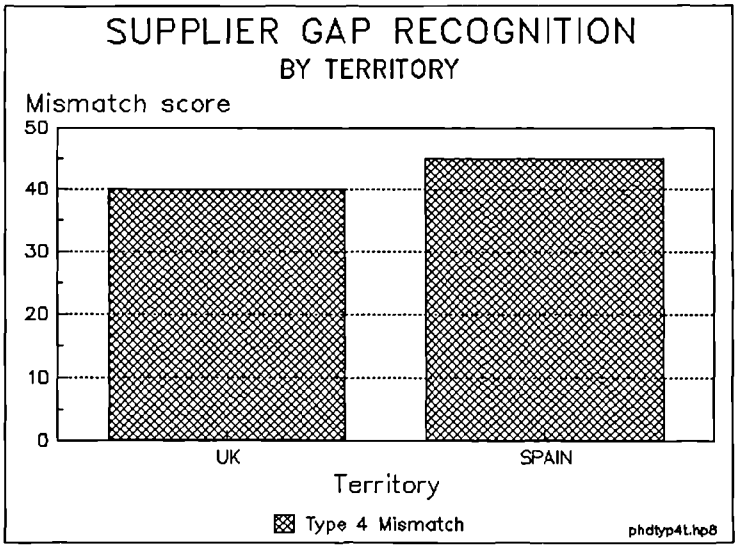


Figure 11.23: Graph showing differences in supplier gap recognition by territory (T4)

The graph above shows little difference between the UK and Spanish chains. The differences were shown to be not significant when a Tukey test was performed.

Differences in supplier gap recognition by product

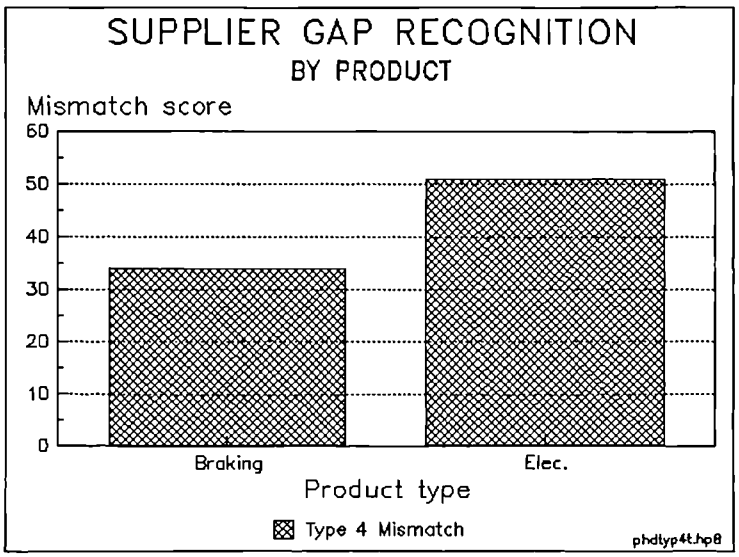


Figure 11.24: Graph showing supplier gap recognition by product

The above graph suggests some difference in Type 4 mismatch between the braking chains and the electrical chains. (This makes an interesting contrast with customer dissatisfaction between product types shown previously - from the customers' perspective, there is no difference at all)

A Tukey test showed the difference in Type 4 mismatch scores by product type not to be statistically significant.

Differences in supplier gap recognition by chain

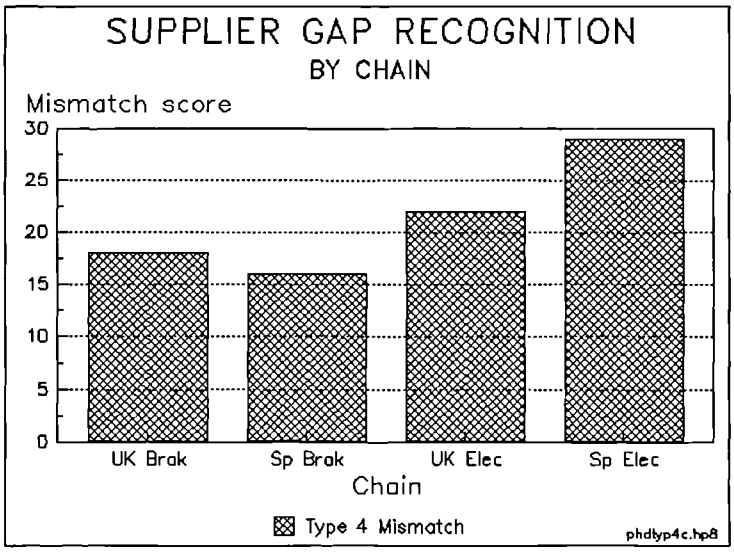


Figure 11.25: Graph showing supplier recognition gap by chain

The above graph shows that there was apparently greater recognition by suppliers of a performance problem in the Spanish Electrical chain than in the Spanish Braking chain. (Again, it was shown previously that customers did not recognise the same gaps).

Statistically, the differences between the levels of suppliers' recognition of a performance gap across the 4 chains was not significant, as shown in a Tukey test.

Differences in supplier gap recognition by dyad

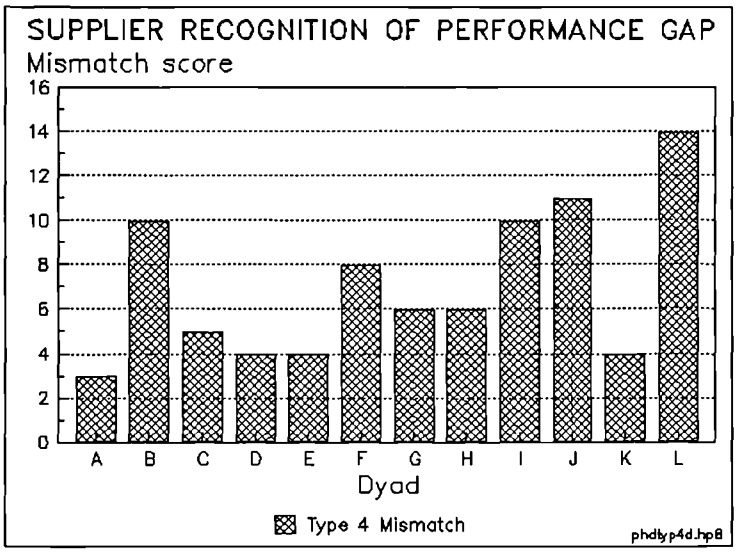


Figure 11.26: Graph showing supplier recognition of performance gap by dyad

It can be seen in the above graph that some dyads e.g. dyad L, show greater levels of recognition of problems in satisfying customers than others e.g. dyad A.

As was highlighted before, whilst visually the differences in levels appear great on a graph, they may not be significant when a robust statistical test is applied to them. As before, the application of a Tukey test showed these differences not to be significant.

Comparing these suppliers views with customer views shown previously gives rise to some interesting observations:

(i) Customer dissatisfaction was greatest in dyad I but this dyad ranked joint third in dissatisfaction levels recognised by suppliers

(ii) Customer dissatisfaction was lowest in dyad D. The total score for supplier recognition of a performance gap in this dyad was at a similar level. However, when compared to other dyads there was more supplier complacency evident in dyad A.

(iii) Customers in dyad A exhibited 3 times the amount of dissatisfaction as that recognised by suppliers.

Some of the possible reasons for these differences will be considered in the next chapter.

Differences in supplier gap recognition by dyadic level

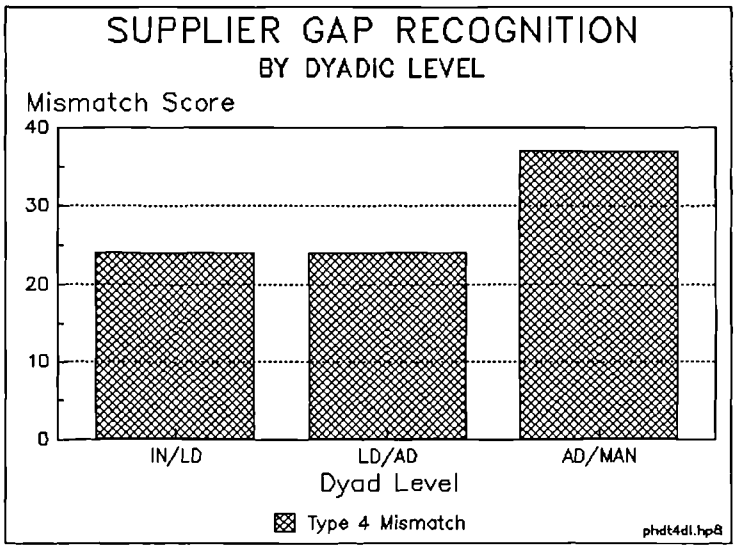


Figure 11.27: Graph showing supplier recognition of performance gap by dyadic level

Once again, an increasing pattern of data moving upstream is apparent in the above graph considering dyadic level. This indicates that manufacturers in the supply chains studied recognise a greater performance gap existing in their relationships than Area Distributors or Local Distributors do.

Having applied a Tukey test for multiple comparison of this data, it was found that these differences were not statistically significant.

ANALYSIS OF DISSATISFACTION / MISPERCEPTION RELATIONSHIPS

In order to ascertain if there is any relationship between customer dissatisfaction (T3) and the presence of misperception either of requirements (T1) or of

performance (T2), the scores for Types 1 and 2 were tested for correlation with scores for Type 3. Using Pearson's correlation coefficient, the following results were obtained:

Relationship	Correlation Coefficient	Significance
T3 and T1	0.191	-
T3 and T2	0.3325	1%

Table 11.11: Correlation of T3 and T1&T2

Given that there were 60 items of data in each set, therefore with 58 degrees of freedom it was found that T3 is correlated to T2 at the 1% level of significance and T3 is not significantly correlated to T1.

Standardisation of scores to remove other influences

The figure below shows the way in which the data being analysed here was aggregated. Patterns in aggregated data of any one variable can influence correlation of other variables. Therefore, the effects of any significant differences in these patterns were removed by converting the variable scores to z scores. This is particularly important to remove effects which may be caused by sample choice.

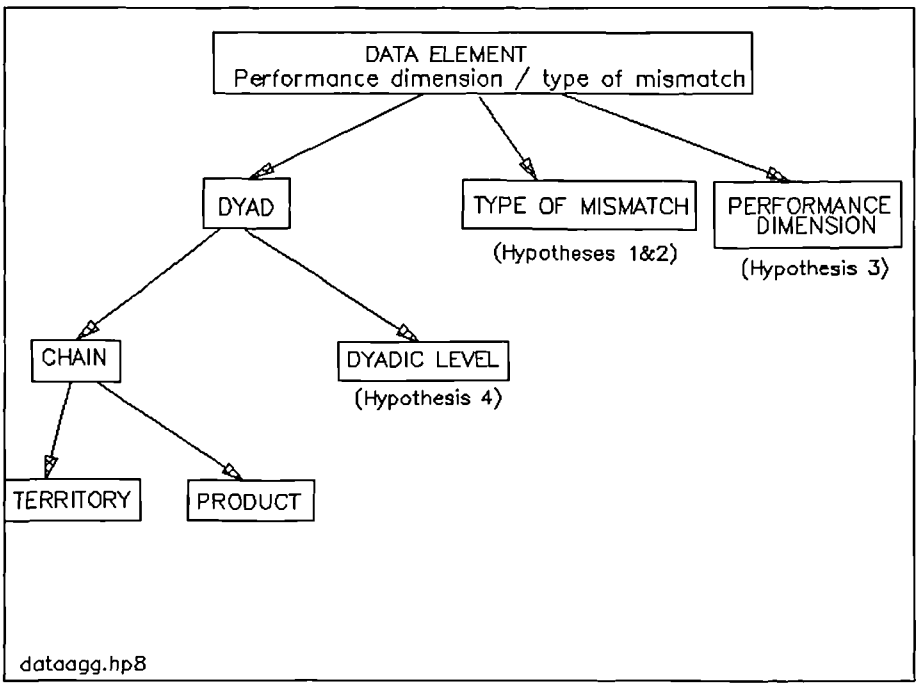


Figure 11.28: Aggregation relationships of the data

It can be seen in the figure above that the individual data element is a type of mismatch within a performance dimension e.g. a type 2 mismatch relating to quality. Therefore, performance dimension and type of mismatch are core pieces of data.

The correlation above tested for relationships in the type of gap. However, it must be established whether these relationships could have been caused by differences between the territories, products, chains, dyads or dyadic levels, all of which are aggregations of data. (It can be argued that it is less meaningful to remove the effects of differences in performance dimension as these are core to the individual data elements).

It has already been established that significant differences did not exist between the data in the 2 territories, product groups or in the 4 supply chains chosen. However, a significant difference was shown to exist between the level of misperceptions of performance (T2) in the dyads. Therefore, this effect was removed and the correlation of T2 and T3 repeated. The formulae and calculated z scores for this are provided in Appendix 4. The results of correlating T3 with T2* (i.e. standardised T2 to remove the dyad effect) are shown below in table 11.12:

Relationship	Correlation Coefficient	Significance
T3 and T2*	0.2452	10%

Table 11.12: Correlation coefficients and their significance for T3 and T2 standardised to remove the dyad effect

Also a significant difference was shown to exist between the levels of misperception of performance (T2) and customer dissatisfaction (T3) within dyadic levels. Therefore it should be tested if the correlation of T2 and T3 is significantly influenced by this. The results of correlating T2** (T2 standardised for the dyad effect and the dyadic level effect) and T3* (T3 standardised for the dyadic level effect) is as shown below in table 11.13 (the standardised z scores are provided in Appendix 4).

Relationship	Correlation Coefficient	Significance
T3* and T2**	0.2243	10%

Table 11.13: Correlation coefficients and their significance for T3 and T2 standardised to remove the dyad and dyadic level effects

It can be seen from the above tables that T2 and T3 are still significantly correlated after removal of the effects of these other variables.

It was identified earlier that a significant correlation did not exist between the misperception of requirements (T1) and customer dissatisfaction (T3). However, it should be tested if this is still the case after T3 has been standardised to remove the dyadic level effect. Table 11.14 below shows the results of correlation after this standardisation (the standardised scores are provided in Appendix 4).

Relationship	Correlation Coefficient	Significance
T3* and T1	0.1689	-

Table 11.14: Correlation coefficients and their significance for T3 and T2 standardised to remove the dyad and dyadic level effects

It can be seen from the above table that T1 and T3 are still not significantly correlated after removal of these other influences.

CONCLUSIONS

The main aim of this research is to compare perceptions of requirements and performance; these comparisons are expressed as types of mismatch.

Frequency analysis of the scores of the four types of mismatch was performed, the mean scores calculated and their meaning in terms of the semantic differential scale used interpreted, with the following results:

Mismatch Type	Mean Score	Meaning
Type 1 - Misperception of requirements	1.617	Slight to moderate difference in views
Type 2 - Misperception of performance	1.933	Slight to moderate difference in views
Type 3 - Customer Dis-satisfaction	2.3	Moderate to substantial difference in views
Type 4 - Supplier recognition of performance gap	1.417	Slight to moderate difference in views

Table 11.15: Mean scores of total types of mismatch

These results showed that customer dissatisfaction scored the highest of all types of mismatch. The difference between total scores for customer dissatisfaction (T3) and supplier recognition of a performance gap (T4) was shown to be **statistically significant at the 1% level of significance.**

Having sliced the data by type of mismatch, within each mismatch type the data was sliced by:

- Performance dimension
- Territory
- Product
- Chain
- Dyad
- Dyadic level

and differences within each of these sub-groups were tested for significance with the following results:

Significance test on differences between:	Results:
T1 by performance dimension	No sig. difference
T1 by territory	No sig. difference
T1 by product	No sig. difference
T1 by chain	No sig. difference
T1 by dyad	No sig. difference
T1 by dyadic level	No sig. difference
T2 by performance dimension	No sig. difference
T2 by territory	No sig. difference
T2 by product	No sig. difference
T2 by chain	No sig. difference
T2 by dyad	Dyads C & D different
T2 by dyadic level	AD/M and INS/LD diff.
T3 by performance dimension	Delivery & price diff.
T3 by territory	No sig. difference
T3 by product	No sig. difference
T3 by chain	No sig. difference
T3 by dyad	No sig. difference
T3 by dyadic level	AD/M and INS/LD diff.
T4 by performance dimension	No sig. difference
T4 by territory	No sig. difference
T4 by product	No sig. difference
T4 by chain	No sig. difference
T4 by dyad	No sig. difference
T4 by dyadic level	No sig. difference

Table 11.16: Summary of results of quantitative analysis by significance testing on differences in data

Relationships between types of mismatch were then tested for by performing correlation tests on the data. The correlation tests were to establish if customer dissatisfaction (T3) was related to misperception of requirements (T1) or performance (T2).

The results of the correlations are summarised in table 11.17 below:

Correlations of:	Results:
T3 and T1	No sig. correlation
T3 and T2	Correlated at 1% sig.

Table 11.17: Summary of results of correlations of raw data

These results will be discussed further in the next chapter which compares and contrasts the qualitative and quantitative analyses, drawing conclusions.

CHAPTER 12 - DISCUSSION OF THE RESULTS

SUMMARY

This chapter discusses the qualitative and quantitative results in the context of the research hypotheses. The following findings were drawn out of the research.

(i) The gap between customers' perceptions of requirements and performance differed significantly from the gap between suppliers' perceptions of requirements and performance. Therefore, it appears advisable to understand what performance problems customers perceive and ensure that suppliers focus on the same.

(ii) Misperception of requirements is not correlated to customer dissatisfaction but misperception of performance is. Therefore, to satisfy customers, suppliers should be more concerned about improving their understanding of performance than of requirements.

(iii) Customers in these chains are significantly more dissatisfied with delivery issues than with price issues. Therefore, suppliers should focus effort on improving delivery performance

(iv) Customer dissatisfaction increases further upstream in these supply chains.

(v) Misperception of requirements does not statistically significantly increase further upstream in these chains

(vi) Misperception of performance does statistically significantly increase further upstream in these chains

Therefore, position in supply chain appears to impact on the extent of misperceptions of performance and on customer dissatisfaction but not on misperceptions of requirements.

INTRODUCTION

This chapter discusses each of the hypotheses derived from the literature and presented in Chapter 7.

For each hypothesis the results of the qualitative analysis and quantitative analyses are provided and discussed. This discussion is then concluded with a view on whether to accept or reject the null and alternate hypotheses formulated. The conclusions are then discussed in the context of the literature.

Firstly, the results of consistency tests performed on the data are briefly summarised.

CONSISTENCY TESTS

It was identified in chapter 7 that certain variables which were not tested for in these research hypotheses could have an influencing effect on supply chains and relationships within them. These variables were identified as being the network context (notably the territory), the product group and the sample choice of supply chains made up of dyads.

It was proven in chapter 11 that no significant differences existed between the data in the 2 territories, the 2 product groups or the 4 chains selected. However, significant differences in the data were proven between dyads and between dyadic levels.

Therefore when correlation was performed, the influence of these variables were removed through standardisation of the data. The results of this are considered later under hypothesis 2 which tests for correlation.

The following sections consider each hypothesis in turn.

DISCUSSION OF HYPOTHESIS ONE

In this section the results of the qualitative and quantitative analysis provided previously in chapters 10 and 11 will be combined to test if this first hypothesis has been proven:

HYPOTHESIS 1

H_0 There is no significant difference between the size of different types of gaps in the chains studied

H_1 A significant difference exists between different types of gaps between customers' and suppliers' perceptions of requirements and performance

This hypothesis investigated the significance of the differences between the 4 gaps studied, as shown below in figure 12.1:

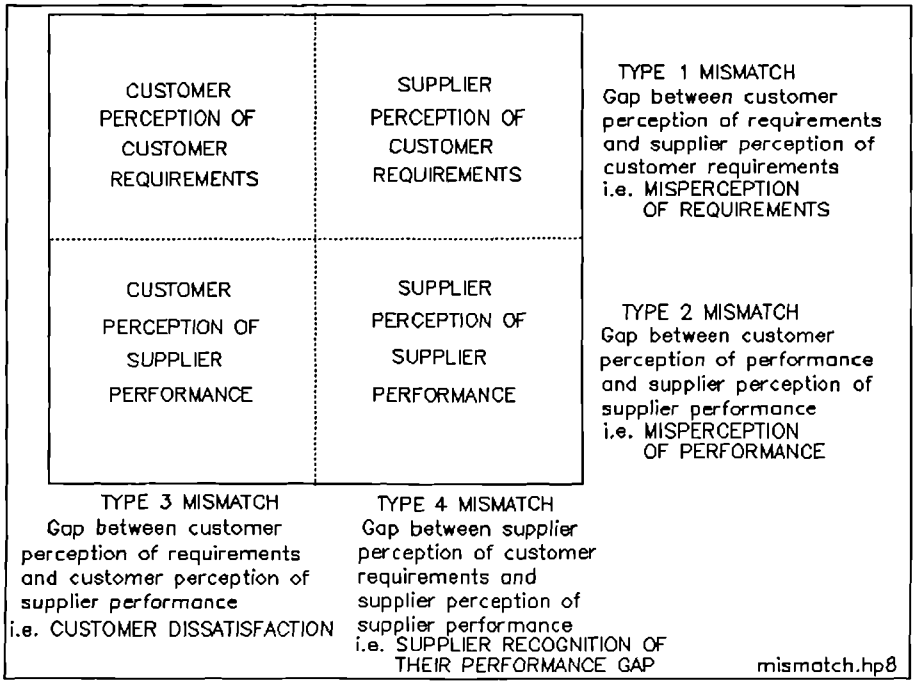


Figure 12.1: Mismatch model showing types of gaps investigated

To reiterate on the nature of each type of gap, their descriptions are provided again here:

A **Type One Mismatch** represents the gap between what the customer in the relationship claims to require and what the supplier in the relationship perceives the customer to require. A mismatch here highlights some possible misunderstanding between the parties about what is required.

A **Type Two Mismatch** highlights the difference between the customer's perception of the supplier's performance in satisfying them and the supplier's perception of their own performance. A mismatch here may highlight difference of opinion about how well the supplier is performing; this may be due to a real difference or, in some cases,

to different measurements being used by each party to the relationship, or to unfounded differences in opinion.

A **Type Three Mismatch** indicates the extent of customer dissatisfaction by showing the gap between what they require and what they think they get in terms of performance from the supplier.

A **Type Four Mismatch** represents the gap between what the supplier thinks is required and what the supplier thinks his performance is. Any mismatch here shows what the supplier may be focusing on to, in his eyes, improve his performance in the relationship. If there is no mismatch, the supplier may not perceive any urgency to improve his performance.

The graph showing scores for each mismatch type given in the previous chapter and provided below in figure 12.2 demonstrates differences in the sizes of gaps identified.

The qualitative and the quantitative results proved the existence of these gaps in the chains studied i.e. there was misperception between the parties about requirements and about performance. Customers in the relationships were dissatisfied and suppliers did recognise some performance gaps.

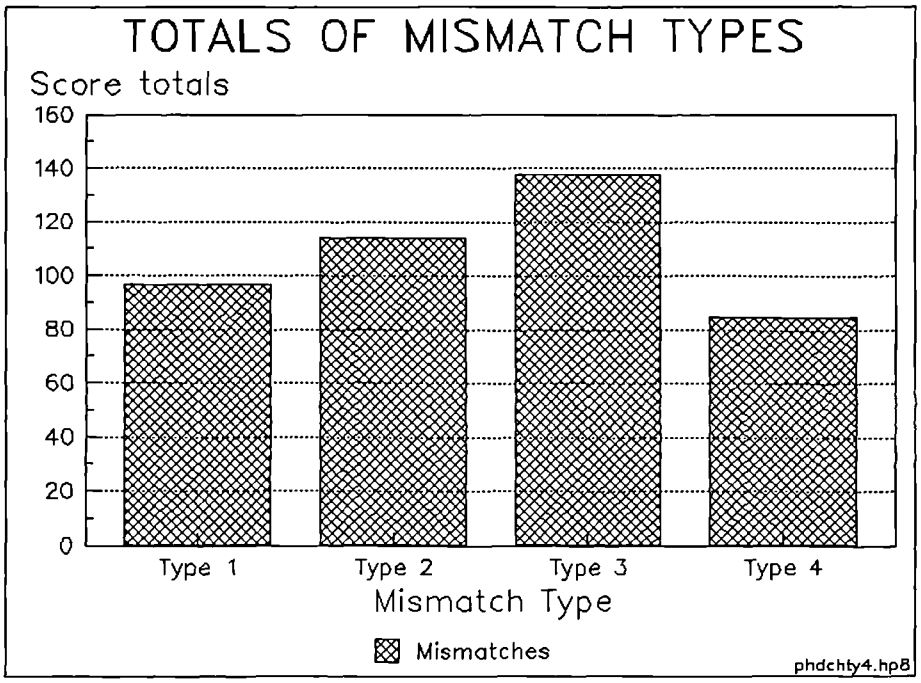


Figure 12.2: Graph showing total scores of each type of mismatch

The qualitative analysis within the dyads provided evidence of supplier complacency; many suppliers viewed their own performance to be no problem when their customers identified significant problems existed i.e. the type 4 gap appeared to be less than the type 3 gap.

In some situations, the supplier appeared unaware of any customer discontent. Some of the worst examples of this related to delivery issues. For example, table 12.1 below from the UK braking chain shows the differences between the installers' and the local distributor's views of the performance gap relating to delivery performance. In other situations the supplier was aware of the problem but disagreed with the customer; table 12.1 below provides an example of this.

It is not unreasonable to conclude that if a supplier only recognises a small performance gap, they may not feel any urgency to improve. This is evident in many cases in the data collected.

There were some situations where the customer identified a performance gap and the supplier also identified a performance gap; however, the gaps referred to completely different problems. For example, in the Spanish electrical chain, the local distributor perceived a performance problem in their inability to supply as many OE specification parts as were demanded by their customers. Their customers, however, did not want OE parts. Instead they were dissatisfied with failure rates of some components.

The qualitative results therefore provided many examples proving the existence of a difference between customers' and suppliers' recognition of a performance gap.

The quantitative analysis confirmed this showing the levels of customer dissatisfaction in the chains studied to be statistically significantly larger than the levels of supplier' recognition of these performance gaps.

INSTALLERS' VIEWS OF DELIVERY REQUIREMENTS	LOCAL DISTRIBUTOR'S VIEWS OF DELIVERY REQUIREMENTS
Delivery is the most important requirement, with 30% of installers specifically wanting delivery within 20-30 minutes, a further 50% within an hour. Some, of different types, require delivery flexibility in urgent cases with delivery within 5-10 minutes.	The Local Distributor believes that all installers want delivery availability as a high priority; this requirement is increasing as installers hold less stock. To satisfy this they aim to deliver within an hour of taking the order. The national menu service and fast fit operators want delivery reliability in particular whereas the independent garages want speed.
INSTALLERS' VIEWS OF DELIVERY PERFORMANCE	**LOCAL DISTRIBUTOR'S VIEWS OF DELIVERY PERFORMANCE**
Half of the installers thought delivery performance was good, one stating it was the best as they would deliver at any time. Delivery speed to the satisfied installers ranged from 15 minutes to 1.5 hours. Average delivery lead time was 3.5 hours i.e. 2 daily deliveries, though one installer only received one delivery a day and had to collect parts between daily deliveries. Some concern was expressed about reliability on Saturdays and late in the afternoon. 2 felt that delivery performance was deteriorating.	Delivery performance is, on average, within an hour. It is too much to expect it any quicker. Generally satisfied with delivery performance
TYPE THREE MISMATCHES	***TYPE FOUR MISMATCHES***
There is a very substantial difference; many installers don't think they receive the speed they want	*The Local Distributor thinks they are satisfying customer requirements for delivery*

Table 12.1: Extract of a mismatch table showing the supplier unaware of a performance problem

AREA DISTRIBUTOR'S VIEW OF DELIVERY PERFORMANCE	MANUFACTURER'S VIEW OF DELIVERY PERFORMANCE
Delivery performance from manufacturer 2 is around 70%. As part of the takeover contract, Area distributor 2 has inherited fixed lead times from Manufacturer 2 which appear to be non-negotiable.	Manufacturer 2 don't agree with the measurements used by Area distributor 2 on delivery performance. As they need at least a couple of months lead time, schedule adherence should be measured against agreed feasible delivery date, not required date. In the last 6 months there have been no back-logs and no late deliveries using their measures. Delivery is on time. Deliveries are made each week.

Table 12.2: Extract of a mismatch table showing supplier disagreeing with a performance problem

Therefore, to conclude, the results proved the existence of these different types of gaps and that there were significant differences in the extent of these gaps in the chains studied. Therefore, the alternate hypothesis **HYPOTHESIS 1** H_1 was proven both qualitatively and quantitatively for the sample chains studied.

DISCUSSION OF HYPOTHESIS TWO

This hypothesis tests for relationships between the four types of gaps, specifically testing for correlation between the extent of misperceptions and customer dissatisfaction.

HYPOTHESIS 2

H_0 A significant relationship does not exist between the extent of misperceptions and the extent of customer dissatisfaction in relationships

H_1 A significant relationship does exist between misperceptions and customer dissatisfaction

This hypothesis was divided into two parts; 2a tested for a correlation of misperception of **requirements** with customer dissatisfaction and 2b tested for correlation of misperception of **performance** with customer dissatisfaction. The results of testing 2a will be discussed first.

The requirements misperceptions / customer dissatisfaction link

HYPOTHESIS 2a

H_0 A significant relationship does not exist between the extent of misperceptions of requirements and the extent of customer dissatisfaction in relationships

H_1 A significant relationship does exist between misperceptions of requirements and customer dissatisfaction

The benefits of suppliers understanding customers' and end customers' needs was supported in the literature by Parasuraman (1985), Carlisle and Parker (1989), Christopher (1992), Jones & Riley (1985) and Barnes (1987). Further, as has previously been identified, a

core concept of marketing is about understanding customers requirements.

It frequently appeared in the qualitative results that high levels of customer dissatisfaction were evident in relationships where there were poor levels of understanding between the parties about what was required. For example, table 12.1 above showed a difference in perceptions of delivery requirements; in this relationship the customer was very dissatisfied with delivery.

However, it also frequently appeared that there was no misperception of requirements but the customers were still dissatisfied. For example, table 12.3 below gives an extract from the delivery mismatch table for the LD/AD relationship in the UK electrical chain which shows no misperception of requirements i.e. the supplier understood what was required.

Despite a clear understanding between the parties, the customer in this relationship was very dissatisfied.

LOCAL DISTRIBUTOR'S VIEW OF DELIVERY REQUIREMENTS	AREA DISTRIBUTOR'S VIEW OF DELIVERY REQUIREMENTS
In stock availability is the most important factor. As long as lead times are about 7-14 days we can work with them. More than speed, predictability is required for the majority of parts. Speed is more important for the slow moving parts which aren't kept in stock or are held in small numbers; distributors are only going to keep part of the range in stock. A good VOR system is required.	Target first pick availabilities are 98% for A parts and 93% for B parts. The aim is to get standard delivery service down to 48 hours from order placement on a weekly cycle; Local Distributors don't need to order on a daily basis. The logistics manager believes that the major order winner is availability.

Table 12.3: Extract of a mismatch table showing the supplier aware of customer requirements

It was difficult using the qualitative data to provide evidence of correlation because in some relationships a relationship appeared to exist but in others it did not. The quantitative analysis performed this far better. The results of the correlation of T1 and T3 are provided in table 12.4 below.

Correlations of:	Results:
T3 and T1	No sig. correlation

Table 12.4: Summary of results of correlation of customer dissatisfaction and misperception of requirements

Having performed a further correlation test to remove the influence of significant differences in data relating to different dyadic levels, this second test also showed that no significant correlation existed.

Therefore, it was not proven that misperception of requirements was related to customer dissatisfaction. Therefore the null hypothesis **HYPOTHESIS 2a H_0** was accepted and the alternate hypothesis was rejected.

The performance misperceptions / customer dissatisfaction link

HYPOTHESIS 2b

H_0 A significant relationship does not exist between the extent of misperceptions of performance and the extent of customer dissatisfaction in relationships

H_1 A significant relationship does exist between misperceptions of performance and customer dissatisfaction

The qualitative results provided many examples of relationships containing substantial customer dissatisfaction where there was evidence of misperception of performance.

For example, table 12.5 below shows extracts from different mismatch tables giving evidence of misperception of performance.

CUSTOMERS' VIEWS OF PERFORMANCE	SUPPLIERS' VIEWS OF PERFORMANCE
Average delivery lead time is 3.5 hours i.e. 2 daily deliveries	Delivery performance is, on average, within an hour
Concern was expressed about reliability on Saturdays and late in the afternoon...delivery performance was deteriorating.	Generally satisfied with delivery performance
Manufacturer 1 is inflexible. We are a real buggeration to the manufacturer because of the small orders and that's how they treat us. OE customers are given lead times of 2-3 weeks but we are given 18-20 weeks. The managers say we are important customers and should be treated as such but when you go a level below that to the module leaders on the shop, they think we're a pain in the bum and they let us know that.	Aftermarket are every bit as important as other customers.
Range performance is variable; B90 and ignition is very good but switch gear and lighting are "mongrel". The range on electronic control units is better than other main dealers, but not good enough yet to push. There are a few ranges where the Area Distributor has less than 70% of the range covered; these won't take off.	In the UK, we are number 1 in electrical parts with 25-30% of the market.

Table 12.5: Examples of gaps between supplier and customer perception of performance in relationships with very substantial customer dissatisfaction.

However, again it was difficult using the qualitative data to provide evidence of correlation. The quantitative analysis performed this far better. The results of the correlation are provided in table 12.6 below.

Correlations of:	Results:
T3 and T2	Correlated at 1% sig.

Table 12.6: Summary of results of correlations customer dissatisfaction and misperception of performance

Further correlation was performed having standardised the data, removing the effects of significant differences in data relating to different dyads and to different dyadic levels. This second test on the data also confirmed that a correlation existed between T3 and T2.

These results confirmed that a relationship did exist between customer dissatisfaction and misperception of performance.

Therefore the quantitative results recommended acceptance of the alternate hypothesis for Hypothesis 2b and rejection of the null hypothesis.

DISCUSSION OF HYPOTHESIS THREE

HYPOTHESIS 3

H_0 There is no significant difference between the gaps between customers' and suppliers' perceptions of requirements and performance associated with different performance dimensions

H_1 There is a significant difference between the gaps between customers' and suppliers' perceptions of

requirements and performance associated with different performance dimensions

As was discussed in the literature chapters, authors including Christopher (1992), Parasuraman et al (1985) and Johnston and Lyth (1989) have identified the value of differentiating between different performance dimensions when considering customer dissatisfaction.

The qualitative results very clearly showed that customers were very dissatisfied with delivery and hardly at all dissatisfied with price. Every dyadic relationship involved in the research exhibited some dissatisfaction associated with delivery whereas over half expressed none or slight problems with price. The nature of the aftermarket makes this less surprising than this might be in some other markets; spare parts for vehicles are distress purchases bought, at the end of the supply chain, at very short notice. They are also not relatively price sensitive.

The qualitative results could not distinguish as well between the performance dimensions that lay, on a scale of dissatisfaction, between price and delivery. It did appear that fewer adverse comments of severity were made about quality than about range and service but this was not entirely clear.

The quantitative results confirmed the polar extremes of delivery and price and clarified the extent of dissatisfaction with the intermediate performance dimensions. The graph shown below, provided in chapter 11, compared the levels of customer dissatisfaction by performance dimension.

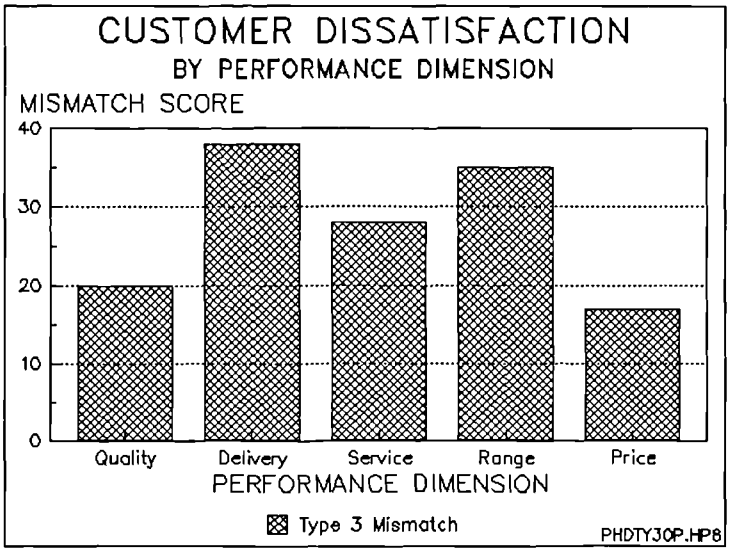


Figure 12.3: Graph showing occurrence of customer dissatisfaction by performance dimension

The above graph showed that the amount of dissatisfaction in the sample associated with delivery performance was more than double that associated with price. The order of dissatisfaction and their scores were as follows:

Rank	Performance Dimension	Customer Dissatisfaction Score
1	Delivery	38
2	Range	35
3	Service	28
4	Quality	20
5	Price	17

Table 12.7: Table showing customer dissatisfaction scores (T3) by performance dimension

To find out if dissatisfaction with any one priority was significantly greater than with any other, statistical Tukey tests were performed. These showed that dissatisfaction associated with delivery was significantly greater than that associated with price; however, the differences between all other pairs of performance dimensions were not statistically significant.

Therefore, it can be concluded that the qualitative and quantitative results supported acceptance of the alternate hypothesis for Hypothesis 3.

DISCUSSION OF HYPOTHESIS FOUR

This hypothesis had been designed to test if position in the supply chain appeared to impact on other variables. Support in the literature on the impact of position in the chain had been provided by authors including Hayes & Wheelwright (1984), Lamming (1993), Nishiguchi (1994),

Barnes (1987), Forrester (1961) and Towill (1982, 1991 and 1992). However, none of these had researched the impact of position in chain on misperceptions in relationships and on customer dissatisfaction. Hypothesis 4 does this.

HYPOTHESIS 4

H_0 The amount of misperception and customer dissatisfaction does not relate to the position in the supply chain; upstream relationships will not exhibit significantly more misperception and customer dissatisfaction than downstream relationships

H_1 The amount of misperception and customer dissatisfaction does relate to the position in the supply chain; upstream relationships will exhibit significantly more misperception and customer dissatisfaction than downstream relationships

This hypothesis was sub-divided into 3 parts testing the extent of 3 variables depending on position in the supply chain. 4a tested the extent of misperception of requirements depending on position in chain, 4b tested the extent of misperception of performance and 4c the extent of customer dissatisfaction. Each of these will be discussed in turn

The position in chain / misperception of requirements link

HYPOTHESIS 4a

H_0 The amount of misperception of requirements does not relate to the position in the supply chain; upstream relationships will not exhibit significantly more misperception of requirements than downstream relationships

H_1 The amount of misperception of requirements does relate to the position in the supply chain; upstream relationships will exhibit significantly more misperception of requirements than downstream relationships

The qualitative analysis provided mixed evidence on the extent of misperceptions of requirements at different positions in the supply chain.

At the INS/LD level there were examples where there appeared to be little misperception of requirements, notably in the Spanish braking chain where the local distributor in this relationship appeared to understand precisely what the installers wanted. However, there were also examples where the local distributor did not seem to understand customer requirements, notably in the UK braking chain.

AT the AD/M level, similarly the results were mixed. There were clear examples of misperception of requirements in the Spanish braking and electrical chains and in the UK electrical chain. However, there was little evidence of misperception of requirements at the AD/M level of the UK braking chain.

The quantitative analysis helped to clarify this.

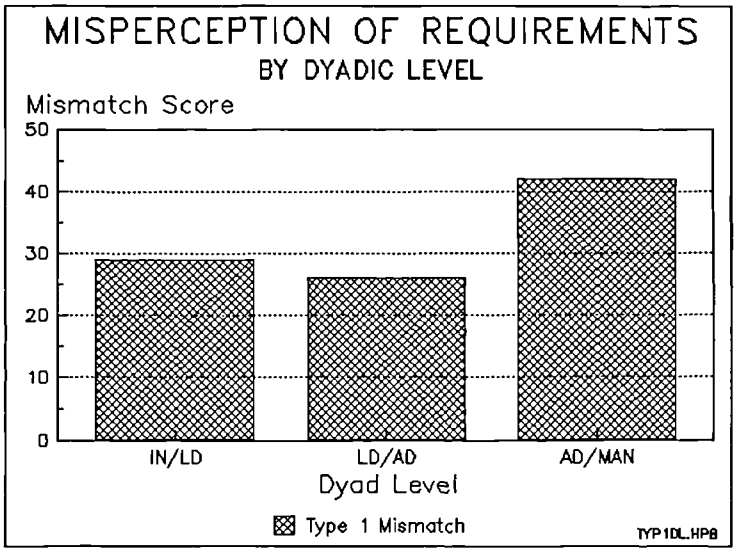


Figure 12.4: Graph showing differences in misperception of requirements at dyadic level

It was apparent from the above graph that clear evidence of a trend in misperception of requirements was not evident. Further, when the differences in misperception of requirements at each level were tested for statistical significance with a Tukey test, this did not find any significant difference.

Therefore, it can be concluded that the evidence did not support that upstream relationships exhibited

significantly more misperception of requirements than did downstream relationships. Therefore, the null hypothesis **HYPOTHESIS 4a H_0** was accepted and the alternate hypothesis 4a H_1 rejected.

The position in chain / misperception of performance link

HYPOTHESIS 4b

H_0 The amount of misperception of performance does not relate to the position in the supply chain; upstream relationships will not exhibit significantly more misperception of performance than downstream relationships

H_1 The amount of misperception of performance does relate to the position in the supply chain; upstream relationships will exhibit significantly more misperception of performance than downstream relationships

At the INS/LD level the qualitative analysis provided examples of relationships where there appeared to be very little misperception of performance, notably the INS/LD relationships of the Spanish braking and electrical chains and the UK electrical chain. However, the INS/LD relationship of the UK braking chain contained a substantial amount of misperception of performance.

At the AD/M level there was evidence of very substantial misperception of performance between parties, notably in the UK and Spanish braking chains. However, the Spanish electrical chain appeared to contain less misperception of performance at this level.

Again the quantitative analysis clarified this.

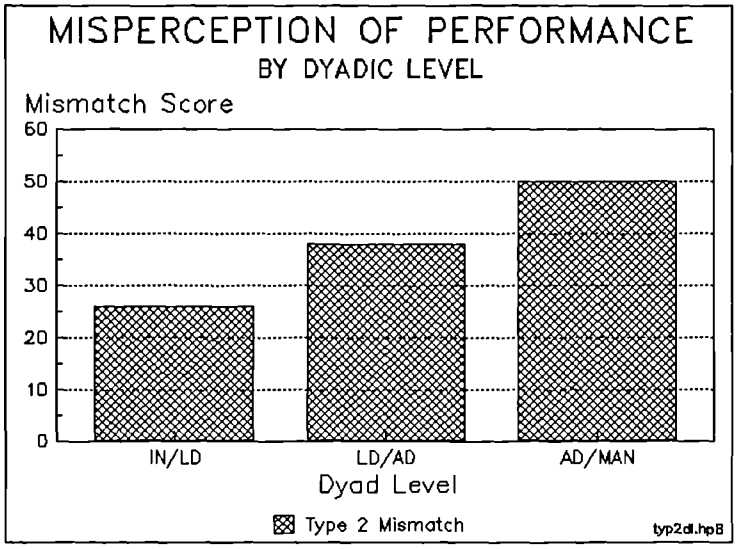


Figure 12.5: Graph showing differences in misperception of performance at dyadic level

As can be seen in the figure above, an increasing trend of misperception of performance existed with moving position upstream. The Tukey tests performed on this data proved that these differences were statistically significant at the 5% level.

Therefore, it was proven that the extent of misperception of performance did relate to position in the supply chain. Therefore, it is recommended that hypothesis 4b H_1 is accepted and the null hypothesis 4b H_0 be rejected.

The position in chain / customer dissatisfaction link

HYPOTHESIS 4c

H_0 The amount of customer dissatisfaction does not relate to the position in the supply chain; upstream relationships will not exhibit significantly more customer dissatisfaction than downstream relationships

H_1 The amount of customer dissatisfaction does relate to the position in the supply chain; upstream relationships will exhibit significantly more customer dissatisfaction than downstream relationships

The qualitative analysis did identify that the most dissatisfied relationships appeared to be at the AD/M level in the supply chain and that the most satisfied relationships were at the INS/LD level.

At the INS/LD level the qualitative analysis provided evidence of very satisfied customers; for example, the comments made below by installers in the Spanish braking chain on the local distributor's service performance clearly show them to be satisfied.

Installers' views of service performance

The Local Distributor circulates technical information periodically, which is appreciated, and provides free training courses. The relationships are very long standing and involve close friendships; the installers don't want to break a long term relationship. They socialise with the Local Distributor quite regularly. There is a high level of trust in the Local Distributor; their reps. are trusted to top up installers' stores on their own. The Local Distributor is viewed as treating installers well and rarely displeasing them. The relationships with other suppliers are good and friendly but the one with Local Distributor 2 is more long-standing. Local Distributor 2 will always ring up if they can't provide a part when they said; they do not unknowingly let installers down. The Local Distributor solves parts problems. They search for rare parts for installers.

However, the installers in the UK braking chain appeared very dissatisfied, particularly with delivery.

At the AD/M level, the qualitative evidence provided examples of **very** dissatisfied customers. For example, the comments made below by the area distributor in the UK braking chain clearly showed them to be dissatisfied.

Area Distributor's view of service performance

Manufacturer 1 is inflexible. We are a real buggeration to the manufacturer because of the small orders and that's how they treat us. OE customers are given lead times of 2-3 weeks but we are given 18-20 weeks. The managers say we are important customers and should be treated as such but when you go a level below that to the module leaders on the shop, they think we're a pain in the bum and they let us know that. As the managers are measured on output, there's only so far they're prepared to go.

However, these examples did not prove that a trend existed overall in the data. Again the qualitative data provided useful examples of extreme cases but the other dyads lying between these on a scale of dissatisfaction were more difficult to analyse qualitatively.

The quantitative analysis helped to clarify this. The figure below was presented in chapter 11 to demonstrate differing amounts of dissatisfaction at each dyadic level.

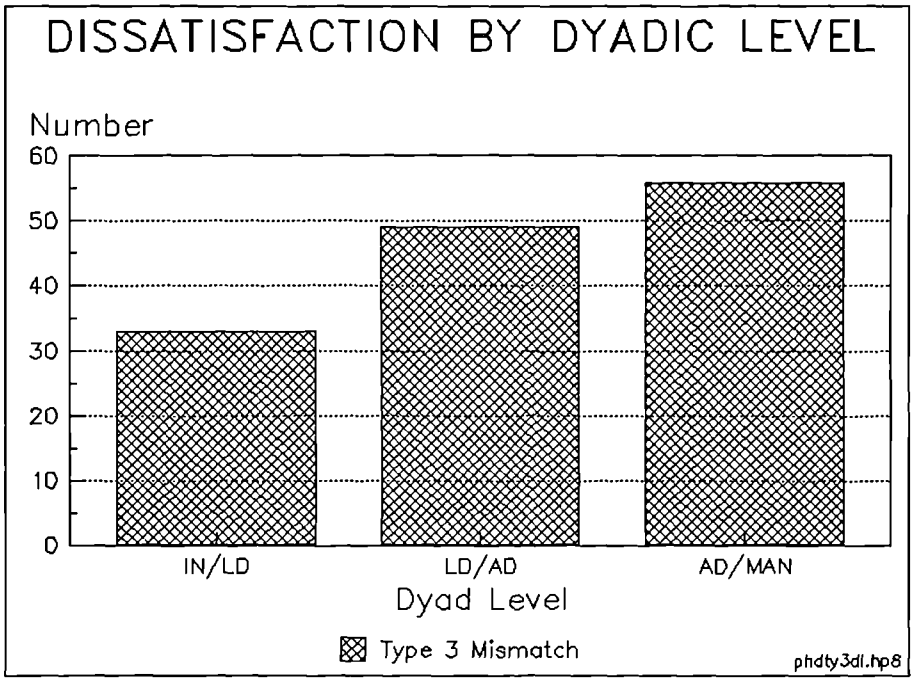


Figure 12.6: Graph showing differences in customer dissatisfaction at dyadic level

Graphically this shows that customer dissatisfaction does increase the further upstream data is collected, in this set of supply chains.

To establish if the differences between the downstream data and the upstream data on customer dissatisfaction were statistically significant, the Tukey tests performed in chapter 11 identified that significantly greater dissatisfaction existed in the AD/M dyad than in the INS/LD dyad.

Therefore it is recommended that the alternate hypothesis **HYPOTHESIS 4c H_1** be accepted and the null hypothesis 4c H_0 be rejected.

CONCLUSIONS

The results of the testing of hypotheses can be summarised as follows in terms of the alternate hypotheses:

ALTERNATE HYPOTHESIS	ACCEPT / REJECT
HYPOTHESIS 1 H_1 A significant difference exists between different types of gaps between customers' and suppliers' perceptions of requirements and performance	ACCEPT
HYPOTHESIS 2a H_1 A significant relationship does exist between misperceptions of requirements and customer dissatisfaction	REJECT
HYPOTHESIS 2b H_1 A significant relationship does exist between misperceptions of performance and customer dissatisfaction	ACCEPT
HYPOTHESIS 3 H_1 There is a significant difference between the gaps between customers' and suppliers' perceptions of requirements and performance associated with different performance dimensions	ACCEPT
HYPOTHESIS 4a H_1 The amount of misperception of requirements does relate to the position in the supply chain; upstream relationships will exhibit significantly more misperception of requirements than downstream relationships	REJECT
HYPOTHESIS 4b H_1 The amount of misperception of performance does relate to the position in the supply chain; upstream relationships will exhibit significantly more misperception of performance than downstream relationships	ACCEPT

HYPOTHESIS 4c H_1 The amount of customer dissatisfaction does relate to the position in the supply chain; upstream relationships will exhibit significantly more customer dissatisfaction than downstream relationships	ACCEPT

Table 12.8: Summary of results of hypothesis tests

The results of the qualitative and quantitative analyses can be concluded as follows:

Conclusion 1

Different types of gaps were shown to exist. The gap between customers' perceptions of requirements and performance differed significantly from the gap between suppliers' perceptions of requirements and performance.

This conclusion should be of great significance to practitioners in supply chains. If suppliers in relationships in the chains are not aware of problems they are unlikely to be motivated to improve.

The literature has identified that many performance measurement systems are inadequate (Johnson & Kaplan 1987, Chandler 1977, Hayes et al 1988) as they were designed to measure performance in price competitive times (Hofer 1983); it is not surprising, therefore, to find problems associated with differences in perceptions of performance.

Supplier performance measurement systems have been reported in the purchasing literature since the 1960s (notably Smith et al 1963) and have been well established since that time (see, for example, Wieters 1976, Stevens 1978, Lee & Dobler 1977, Jones (Harland) et al 1987). These systems have involved buyers (customers) measuring suppliers across a range of performance dimensions including quality, delivery, service and price. However, it is only recently that operations management appears to have responded to the significance of measuring these externally oriented performance dimensions (Hayes & Wheelwright 1984, Hill 1985, 1989 and Slack 1991).

It is only recently that operations management (through service management) have considered softer aspects of that performance (for example Parasuraman et al 1985, 1988, Johnston & Silvestro 1990 and Fitzgerald et al 1991). Also it is relatively recently that the differences in expectations (Voss et al 1985) and perceptions of performance (Parasuraman 1985, Gummesson 1987 and Berry & Parasuraman 1991) have been widely recognised in the service operations area.

Therefore, it is understandable that perspectives of performance may differ between customers and suppliers.

Conclusion 2

Misperception of requirements is not correlated to customer dissatisfaction.

This is very interesting and certainly warrants further exploration. Understanding customers' requirements has been core to marketing since its inception (Kotler 1991) and its link with customer dissatisfaction has been well established in the consumer behaviour literature (Cardozo 1965, Swan & Combs 1976, Oliver 1980 and Churchill & Suprenant 1982) and more recently in the service management literature (Berry & Parasuraman 1991, Brogowicz et al 1990, Gronroos 1990 and Haywood-Farmer & Nollet 1991. It is interesting that this research challenges this literature. The implications of this will be considered in the next chapter.

Conclusion 3

Misperception of performance is correlated to customer dissatisfaction.

This research did not attempt to establish any "real" or "actual" performance in the relationships. This finding supports the view in the literature of the importance of understanding customers' perceptions of performance, as opposed to a notional "actual" performance or the suppliers' perceptions of performance (see Sasser et al 1978, Parasuraman 1985, Gummesson 1987, Berry & Parasuraman 1985, Cronin & Taylor 1992, Haywood-Farmer &

Nollet 1991, Carlisle & Parker 1989, Zeithaml 1988 and Zeithaml et al 1990).

This finding goes beyond this literature by positively identifying a link between misunderstanding about performance and subsequent customer dissatisfaction i.e. it proves the implications of suppliers not understanding the problems in the relationship. This lack of understanding could be causing the supplier to be focusing on the wrong aspects of performance and therefore failing to meet the customers' expectations. This was apparent in the INS/LD relationship of the UK braking chain studied. Alternatively, it could be giving rise to a worsening attitude in the customer who recognises the suppliers misperception of performance and views them as being in dispute about it - this was the case in the AD/M relationships in the UK and Spanish braking chains.

Viewed in the context of the previous conclusion, this conclusion is potentially far more interesting i.e. removing misperception of performance appears more likely to influence customer satisfaction / dissatisfaction than removing misperception of requirements.

Conclusion 4

Customers in these chains are substantially more dissatisfied with delivery issues than with price issues

This supports the view in the literature that needs for different dimensions of performance vary. This has been well established in the purchasing and partnership literatures which has provided models to measure the relative importance of these different dimensions (for example Ferguson et al 1989 and Macbeth 1989a) and to weight them (Wieters 1976, Roberts 1978, Dempsey 1978 and Gensch 1984).

Birt & Cousins (1993) identified that the buyer and supplier in a partnership must decide what is important to them i.e. a generalised set of weighted dimensions is not required, but rather a tailored set for each relationship.

However, the approach to date has been of trying to understand in detail the differences between each performance dimension; all the models of aggregation and weighting from the purchasing management literature and the service management literature suggest some kind of mathematical calculation is required to manage across these different dimensions.

Had the results here shown that, whilst differences between performance dimensions existed, these differences were not significant, it could have been argued that this aggregated, weighted, rational view was appropriate. However, as most of the problems related to the dimension

of delivery, it could be argued that a pragmatic, simple approach of focusing on delivery initially would be advisable.

This is not to imply that the other dimensions be allowed to go off track completely, but if the case company wanted to improve performance in these supply chains, it could be argued that they would be better advised spending time improving on the delivery dimension **then** spending time finding out in more detail the nature of problems associated with other dimensions.

The next three conclusions will be treated together.

Conclusion 5

Misperceptions of requirements do not significantly increase further upstream

Conclusion 6

Misperceptions of performance do significantly increase further upstream

Conclusion 7

Customer dissatisfaction increases further upstream

These findings have not been reported to date in the literature.

They do echo the view expressed in the literature that position in the supply chain will have an affect. Specifically, Hayes & Wheelwright (1984) identified that position in the chain will have implications regarding demand volatility, asset intensity, profitability, technological change and scale and balance. However, they did not provide empirical evidence to support this. Empirical evidence has been provided by the industrial dynamics literature to support the affect of position in the chain on demand volatility, notably by Forrester (1961), Burbidge (1961 and 1984) and more recently by Towill (1982, 1991, 1992). Core to this work is the "Forrester Effect" of amplification of distortion of end customer demand through the supply chain.

As this finding is new it should be viewed with extreme caution. There are many possible causes of this effect which were not investigated here. For example, it is possible that the dissatisfaction was linked to size of firm rather than to position in the chain i.e. the small is beautiful argument. This point will be discussed further in the next chapter.

However, it does present an interesting finding which, considering the logic of the Forrester effect on planning and control issues, does highlight the possibility that a similar effect in supply chains may be influencing other decision making and performance aspects.

This piece of research has established that, in these supply chains, misperception of performance is linked to customer dissatisfaction. Therefore, as customer dissatisfaction has been shown to increase further upstream, it is logical that misperception of performance may do likewise. Similarly, as misperception of requirements was shown not to be linked to customer dissatisfaction, then there is no reason to expect that this to increase upstream.

These conclusions, in addition to proving a chain effect, also support the previous finding that misperception of performance is correlated to customer dissatisfaction but misperception of requirements is not, thereby performing a validation of the correlation.

Having drawn out conclusions and discussed them in the context of the hypotheses, the next chapter discusses them in the broader context of supply chain management and operations management knowledge.

CHAPTER 13 - CONCLUSIONS AND IMPLICATIONS FOR THEORY

SUMMARY

This chapter reflects on the methodology used in the research, finding the research approach, paradigm, methodological foundation and methods used appropriate to the work. In particular, the effectiveness of the mismatch model as a tool for data gathering in interviews and for comparative analysis is reviewed. It was limited by the ability of the interviewee to express their requirements. Also care had to be taken in allocating responses to the performance dimension categories. It did, however, provide good information on gaps in perceptions of customers and suppliers about requirements and performance.

The sample chosen was found not to have biased the results adversely.

The qualitative analysis provided rich pictures of the relationships studied. It performed well at identifying extremes of gaps. However, the pictures were not as clear between these extremes. The quantitative analysis provided detail between the extremes in the data. It enabled multi-variable comparisons, providing different slices of analysis.

Implications of the research for supply chain management theory are (i) it is important in relationships to understand the customer's perception of performance (ii) supply chain roles and responsibilities can be identified (iii) position in chain appears to have communication and performance implications.

Implications for operations management theory are (i) supply chain management is a natural extension to the trend of externalisation (ii) the Parasuraman et al gap model can be criticised for its lack of consideration of suppliers' perceptions of performance (iii) the issue of critical performance dimensions and trade-offs should be viewed in context of Wheelwright & Hayes 4 stage model and Ferdows and De Meyer's sandcone model (iv) operations management needs to understand more about the implications of position in chain (v) supply chain management could be an integrating concept to bind the disparate service management and production management groups together.

It is concluded that supply chain management is a new, evolving, strategically important concept which presents great opportunities for further research.

INTRODUCTION

The previous chapter discussed the research in the context of the hypotheses. This chapter steps back to review the research more broadly.

It is necessary that research, and most particularly research in new subject areas, reflects on the appropriateness and performance of the methodology employed. This chapter initially reflects on the social science, primarily qualitative, more rational approach taken. It then reflects on the functionalist paradigm and the empirical methodology that involved objective observation, rather than interpretative or self critical analysis. Specifically the method of semi-structured interviewing and the tool of the mismatch model is reviewed.

Chapters 10 and 11 described the results of the qualitative and quantitative analysis performed on the data; the analytical steps are reviewed here.

Having reflected on the methodology, this chapter then reflects on the results in terms of the supply chains studied, the relationships within them and the network within which they existed.

More broadly, the work is viewed in terms of its implications for supply chain management and for operations management.

REFLECTION ON THE RESEARCH METHODOLOGY

Reflection on the approach

The general research literature reviewed in chapter 8 favoured a social science approach over a scientific approach to perform research in a social science area (see for example Bryman 1989, Oliga 1988 and Galliers & Land 1987). Despite this, operations management authors had identified and criticised the tendency for operations management research to adopt a scientific approach (see for example Buffa 1980, Miller & Graham 1989, Meredith et al 1989 and Flynn et al 1990).

This research adopted a social science approach, partly in response to the criticisms but mainly because it was more appropriate to the problem domain. However, that approach causes the results of the research to be exposed to criticism by supporters of scientific approaches for its lack of repeatability, reductionism and refutability (Checkland 1981b). If research rigour is viewed in terms of these performance dimensions, then this work would be found lacking in rigour. However, the supporters of the social science approach would elevate the main benefit of the approach above these "failings" i.e. its reflection of the real world. This research was based on field work and reflected the real world, rather than creating an artificial simulation of reality.

Whilst the data collected in this research was quantified to allow further analysis, the epistemological stance on which the research was based was qualitative, gathering and reporting verbal perceptions and attitudes from interviewees rather than gathering hard, quantitative data from company information systems and reports. Using Morgan & Smircich (1980) and Bryman's (1989) distinctions, qualitative research explores people's understanding of their environment whereas quantitative research treats facets of the environment as objects like physical or biological matter. On reflection, quantitative data to reflect these perceptions and attitudes would not have been available in the supply chains studied, even if the research had sought to gather it.

The research performed was more rational / deductive than existential / inductive in that reasons why individuals expressed certain perceptions were not investigated nor were interpretations of their views attempted. Views were merely recorded and observations made about differences between views. On a scale from rational to existential, this research lay closer to rational but was not at the polar extreme of identifying hard irrefutable truths. The fact that gaps in perceptions existed demonstrated that these views did not represent irrefutable truth. On reflection, for the research to be of more value to operations managers in practice, greater interpretation of the expressed views is required.

Reflection on the paradigm

The functionalist paradigm was adopted for this research; this is an objectivist paradigm which assumes that the researcher can stand back, make observations, then use these observations to explain what is occurring. This dissertation made such observations then analysed them to find patterns. Following from the comments made above, for the research to be of greater value to operations managers, an interpretive paradigm would help to explain behaviour in the supply chain. Further still, a radical / critical paradigm may enable supply chain members to expose behaviour in the supply chain and help themselves to work to change it.

Critical and interpretive research in supply chain management would be invaluable, once the fundamental concepts and frameworks are established within which it could be performed. However, as the subject is so new and these concepts and frameworks are not yet agreed, in depth interpretive or radical / critical research may be difficult to perform.

Reflection on the methodology

The methodology adopted for this research was empiricism which assumes that knowledge can be gained by studying hard structures. Further, the methodology was positivist in that it is assumed that by performing more empirical research, these different pieces of research can be pieced together to build knowledge.

Pragmatically, supply chain management is so new it would have been difficult to persuade the Case Company to participate in less positivist research. However, as the empirical knowledge grows, and the subject area becomes more widely accepted in companies, research employing more interpretive methodologies such as hermeneutics or self critical methodologies such as critique is likely to be more easily facilitated.

Reflection on the methods

It was identified in chapter 8 that the appropriate research method for this research was semi-structured interviewing.

Whilst an underlying assumption of an empiricist methodology is that the researcher can be objective and not influence findings with his / her own values, it was identified in chapter 8 that the method of semi-structured interviewing can be influenced by the researcher. Every researcher brings their own baggage of education, experience, personality and capability to the research. However, I sought to reduce bias of my influence by using a researcher to perform or contribute to the interviews (however, that researcher also brings with them their own baggage). Further attempts were made to reduce bias in the most subjective part of the research - allocating scores to the degree of mismatches

in the relationships. This was validated by another person.

The tool used to help structure the interviews and illicit the required information was the mismatch model. This was applied to each performance dimension in each party of each dyad to establish both parties' perceptions of requirements and performance. There were limitations of this model.

Firstly, the interviewees showed varying ability to express their requirements; this experience was also found by Zeithaml et al (1990) at the consumer end of the supply chain, particularly where the customer is buying a relatively intangible package. It is recognised that, increasingly, manufacturing organisations are competing on service aspects of their package (see, for example Albrecht & Bradford 1990 and Martin & Horne 1992). Therefore, as this **servicisation** of operations takes place, difficulty in expressing requirements because of intangibility is likely to be present further up the supply chain.

However, this difficulty of expressing views is symptomatic of the limitations of the interview method. A practical approach was taken to this; where ambiguities in the responses were evident, these were discussed in the semi-structured interviews until they were clarified. If one interviewee was incapable or unwilling to clarify

these, further interviews with other personnel were carried out. (The brief company profiles provided in Appendix 1 show the number of interviewees in each organisation).

A second limitation of the mismatch model related to the categorisation of views into the main performance dimension headings of quality, delivery, service, price and range. This was not always clear cut for the interviewee and the interviewer in some cases. For example, issues relating to the provision of and management of warranties straddled the technical support aspects of the service dimension and also the quality dimension. Also the inability of a company to take orders mid-week could be viewed as delivery flexibility or as sales order processing service.

However, the same approach was applied to all the data; generally comments relating to softer, people oriented aspects were categorised as service issues whereas harder, system oriented aspects of each dimension were classified under these harder variables. Therefore, whilst other researchers in supply chains may choose slightly different classification of comments into these categories, providing a consistent approach is used for any one piece of research and the interpretation of the findings is made in the context of the definitions adopted, any categorisation effects on the data should be limited.

The main benefits of the mismatch model are as those reported by Carlisle and Parker (1989) relating to their original four-way assessment model. Namely, the model is a useful tool to be used in initial analysis in relationships to identify the areas where gaps may occur in perceptions. Despite the above limitations, the model was able to perform this function. The mismatch model is discussed further later when the implications of this research for gap models are considered.

Reflection on the sample

The size of the sample was chosen as a minimum size to enable tests on possible effects caused by differences between territories (see Achrol et al 1983, Hakansson 1982, Lamming 1989 and 1993, Gladwin & Walter 1980, Bartlett & Ghoshal 1992, Ohmae 1989 and Klassen & Whybark 1994) and differences between product / process types (see Christopher 1985, Lamming 1989, Curran & Stanworth 1983, Kotler 1984 and Barnes 1987).

Reflection on the territories

Statistical Tukey tests were performed which showed no significant difference in the results between the UK and Spanish territories. This indicated that any differences between territories were not underlying causes of the observed patterns in the data.

UK	SPAIN
Wants immediate availability of information. Likes to know people at the supplier so he can "growl at them".	Wants a supplier to look for a part if it's not in stock. Needs to be able to place orders by phone for urgent parts and for distributors to come and restock for them for repeat parts (and on their own if storemen aren't there) - trust and confidence in the rep. is required because of this. Wants friendship; wants an intimate relationship with suppliers. Where more than one stocks a part, he'll choose on the basis of his relationship with one.
No services are required from the local distributor; he gets technical information from elsewhere.	Wants to be well looked after. Wants a very correct relationship. Wants faulty parts to be swapped.
No service expectations	Values a good relationship with the rep.
Not really interested in service aspects	Does not want a woman in charge at the local distributor - believes it will mean poor service. Wants friendship from the relationship. In the future there will be a greater need for technical information as the car parc is changing so much.
Wants promptness in answering the telephone	Friendly relations are essential for the survival of the business. In the future, the installer will need to have access to diagnostic test equipment. He also sees the local distributor as having to provide more technical support and advice.
Wants accuracy and efficiency in invoicing	Wants suppliers to have experience and knowledge. Wants suppliers to trouble themselves to locate parts. Wants friendly relations with sales people; it is important that sales people have good technical knowledge and experience so they can advise the workshops on appropriate parts.
Wants accuracy in interpreting the order	Wants technical information and training.

Table 13.1: Differing service expectations of installers

This was a surprising result, given that the research highlighted differences in requirements and approach in both territories. The table provided above indicates contrasts between the installers in the UK and Spain.

The Spanish business culture appeared to be one favouring trust and long standing relationships whereas the UK business culture apparent in these supply chains was more adversarial. During the research, these differences were flagged up to the case company as contrasts of good and bad practice, resulting in some pillorying of the UK companies involved.

However, with the benefit of hindsight, the results of this research indicate that neither approach was significantly better or worse in terms of customer satisfaction, just different. This raises questions about whether the currently fashionable view extolling the benefits of the quasi-organisation of co-operation, trust and mutual respect is appropriate to all relationships in every territory. If the UK companies want to be stereotypical "wingeing pommies", maybe they should be allowed to do that in relationships which do not require substantial knowledge sharing.

Reflection on the product groups

The research was carried out in 2 braking products and 2 electrical products chains. Despite apparent differences between these product types and the nature of support

related to them, the results found that no statistical difference existed between the data in both.

Reflection on the chains

The choice of the number of supply chains was a classic trade-off of depth and breadth of research. The depth of the research into customers' and suppliers' perceptions of requirements and performance across five performance dimensions made wide sample breadth impractical. Broader research which compared and contrasted very different supply chains from other industries would have been interesting but was necessarily prohibited by the depth of the research and the methods used.

Four supply chains were chosen which lead to interviews in 50 different organisations. The scale of facilitating the research in particular made examination of more chains impractical for this dissertation.

Statistical Tukey tests were performed across the four chains to ensure that differences between the sample chains chosen were not influencing the results; these tests showed no significant differences between the chains.

Reflection on the analysis

The qualitative analysis involved comparing textual comments in the mismatch tables to enable observations about patterns in the data. This proved powerful within

each dyadic relationship, providing a rich picture of the perceptions of both parties.

It was possible from the qualitative analysis to make cross dyad comparisons of extreme cases of harmonious and sour relationships. Observations could also be made on the extent of misperception and dissatisfaction relating to extreme differences between performance dimensions.

However, the quantitative analysis managed the cross variable analysis more easily and objectively. It enabled the data to be sliced and re-sliced in many different ways to identify patterns.

The quality of the quantitative analysis depended on the quality of the scores allocated to the text comments in the mismatch tables. The scores related to a semantic differential Likert scale. Users of Likert scales have identified some of their failings (see, for example, Lundstrom & Lamont 1976); these include the inability of the user to apply uniform differentiation between points on the scale. For example, the difference between 1 and 2 may not be the same as between 4 and 5. However, semantically differentiating between points on the scale using phrases such as "slightly dissatisfied" and "harmonious" helped consistency in the application of the scores. Further consistency checking was provided by having half the data scored by another person, then performing statistical tests on the closeness of the two

sets of scores. On reflection, the proportion of identical scores in the validation exercise gave confidence of the integrity of the scoring process and the scores themselves.

Having assigned scores to the qualitative gaps in perceptions, frequency analysis provided a view of the existence of particular patterns; this enabled mean scores to be calculated. The calculation of means provided a more objective view of the overall level of agreement which was difficult to gain from the qualitative data alone.

Graphical representations of the data provided clear pictures of the relative levels of scores. Again, it is difficult to view qualitative data this objectively; observations about polar extremes are possible but sorting out the intermediate values is difficult - a problem of seeing the wood for the trees.

The Tukey tests performed for each "slice" of the data enabled statistical determination of the significance of the differences between variables. Had the graphs alone been relied on, different observations would have been made i.e. graphically some differences looked great but statistically could have been attributed to the sample variation rather than any significant differences. This does not invalidate using the graphs; indeed, they provided the most powerful means of initial comparison.

However, it does highlight that visual differences within a sample cannot be relied upon to prove hypotheses about populations.

Correlation was performed to identify relationships between variables. This could not have been performed safely using the qualitative results alone. Correlation on the raw scores showed evidence of positive correlations between some variables. However, statistical methods dictate that influences should be removed from the data by standardisation to observe whether an underlying correlation exists without that influence. This process gives rise to some important considerations:

(i) In multi-variable analysis such as this which identified significant influences on the data set, a rationale for choosing to standardise variables needs to be understood. There is no right answer on which variables should be standardised. Technically, it could be argued that all variables exhibiting significant differences should be standardised.

(ii) If more than one variable is standardised, the progressive standardisation has to be done in an order; choosing this order requires a reasonable rationale.

(iii) Standardisation of data removes real effects, moving the data away from reality into the abstract.

(iv) Comparing results of correlations should be done cautiously. Correlations of standardised data should not automatically be judged to be truer results.

(v) With progressive standardisations, correlations can move in and out of significance, highlighting that caution should be applied to the notion of significance. Rather than "pass or fail" it can be interpreted more realistically as a guide-line, though many statisticians are uncomfortable with this.

To conclude, no major concerns or omissions were identified regarding the methodology; it performed the task required.

Having reflected on the methodology of this research, the next section reflects further on the results.

REFLECTION ON THE RESULTS

Conclusions of usefulness of the findings

Menon and Vadarajan's (1992) research indicated that research findings are often not effectively used by

organisations. Shrivasatava (1987) proposed the following criteria to examine the usefulness of research; it is proposed here that paying attention to these criteria may help ensure organisations are able to use research results more effectively.

1) **Meaningfulness:** Information must be of personal interest and must make sense to users

2) **Goal relevance:** Information must relate to the tasks facing users

3) **Operational validity:** Knowledge should be action oriented and such that something can be done with it

4) **Innovativeness:** The information should be non-obvious

On reflection, considering the nature of the research, its strategic importance and its reception by the Case Company, it appears that the findings of this research satisfy all four criteria of usefulness.

The research findings were discussed in the previous chapter in the context of proving hypotheses. This section reflects further on the results.

Reflection on gaps identified

All the relationships studied showed some evidence of customer dissatisfaction and misperception. The levels of customer dissatisfaction were significantly higher than suppliers perceived them to be. The proven correlation of misperception of performance with customer dissatisfaction indicates that suppliers are misperceiving the performance gap, not because they do not understand what's required, but that they do not share the customer's perception of how they are performing. This contradicts the views expressed in the literature (e.g. Cohen and Lee 1990, Christopher 1992, Harland et al 1993, Jones & Riley 1985) which favour understanding customer requirements.

These observations specific to the chains studied will be reflected on more generally in the following sections to consider the implications for supply chain management and operations management.

IMPLICATIONS FOR SUPPLY CHAIN MANAGEMENT THEORY

Managing relationships

This research proved that customers' dissatisfaction is significantly influenced by the lack of understanding in the relationship about performance in these supply chains. More importantly, this was highlighted as having

more of an effect on customer dissatisfaction than lack of understanding of requirements.

This fundamentally questions knowledge to date on relationships which apparently insists that good suppliers understand their customers needs, bad suppliers do not. Instead, it implies that good suppliers know what customers think of their performance, bad suppliers do not. If proven in further research, this should elevate the importance of performance measurement above understanding requirements in our research and teaching about relationships.

This finding challenges marketing whose core concepts and emphasis have, to date, focussed more on understanding needs, wants and demands than on understanding performance to customers. It also challenges the views expressed in the limited body of supply chain management knowledge. In particular, work by Christopher (1985, 1989 and 1992), Jones and Riley (1985) and Jones (Harland) et al (1989, 1990a, 1990b, 1990c, 1991, 1993) have insisted that understanding requirements of end customers and their translation in the supply chain is of paramount importance. The need for more research to establish the general applicability of these results in other supply chains is evident. If this fundamental importance of perceptions of performance is proven, the focus of supply chain management should shift.

The findings of this research also revealed the vulnerability of customer dissatisfaction to particular performance dimensions. It would appear sensible in relationship management to find out the main dimension which is dissatisfying customers and work to improve performance against it. Pragmatically, this is an attractive approach to improvement and echoes incremental approaches found in TQM. Results of improvements are likely to be visible more quickly; communication, education, training and changes in performance measurement within a business could be performed more rapidly and more effectively on one dimension at a time.

This questions the usage of complex multi-dimensional performance measurement systems which derive aggregate views of performance across an entire spectrum of dimensions. It appears to endorse Parasuraman et al's (1988) revision to a more limited set of dimensions and question Fitzgerald et al (1991) and Johnston & Silvestro's (1990) increasing the number of dimensions in measuring service quality.

It is not clear whether these supply chains are typical in their sensitivity to particular dimensions; further research in other relationships in other chains would be required to establish this.

Position in chain - a Forrester effect?

This work has added to knowledge that recognises gaps in relationships. These relationships form chains; therefore any gaps in relationships are necessarily gaps in chains. Industrial Dynamics authors, notably Forrester (1961), Burbidge (1961 and 1984) and Towill (1991, 1992) have defined, proven the existence of, and proven the effects of gaps in hard information flows in supply chains. These have been proven to increase in amplitude with increasing position in the supply chain.

This research has identified increasing amplitude of soft gaps - gaps in both parties' perceptions of performance and gaps between customers' expectations and their perceptions of performance. The nature and size of these gaps were not tested for conformance to the Law of Industrial Dynamics (Burbidge 1984); observations of possible similarities in principle are all that can be made here. However, it does create the need for further research to specifically investigate Forrester type effects on softer, performance oriented dimensions.

IMPLICATIONS FOR OPERATIONS MANAGEMENT THEORY

This section brings out broader implications of this work in supply chain management for the subject of operations management. This discussion is structured to consider (i) the externalisation of operations management (ii) measuring external performance (iii) position in a supply

chain (iv) the integration of disparate bodies of operations literature.

Supply chain management - a natural extension to externalisation of operations management

It was identified in chapter 2 that operations management has become more external in its focus, particularly through the work of the manufacturing strategists since the mid-1980s and through the consumer orientation of service management.

Supply chain management extends this trend by developing a conceptual framework for inter-organisation operations management. This mirrors similar developments in the information systems area (see, for example, Johnston & Vitale 1988 and Malone et al 1989).

This shifts the focus of externalisation up a level to think in terms of chains rather than single company. Interestingly, if the subject of operations management develops further at a chain level, the notions of **external** and **internal** would require rethinking. External for a supply chain would relate to the end customer. Internal would relate to the process and operations of the chain players, viewed as an integrated whole.

Theory and knowledge in operations management has a long way to go to step up to this level.

Measuring external performance

The contribution to knowledge of this research is divided here into reviewing gap models and also trade-offs.

Gap models

This research has questioned knowledge on the relative importance of understanding requirements and understanding perceptions of performance in relationships.

The most widely accepted gap model identifying gaps in perceptions of performance and expectations within operations management is Parasuraman et al's (1985) shown below in figure 13.1:

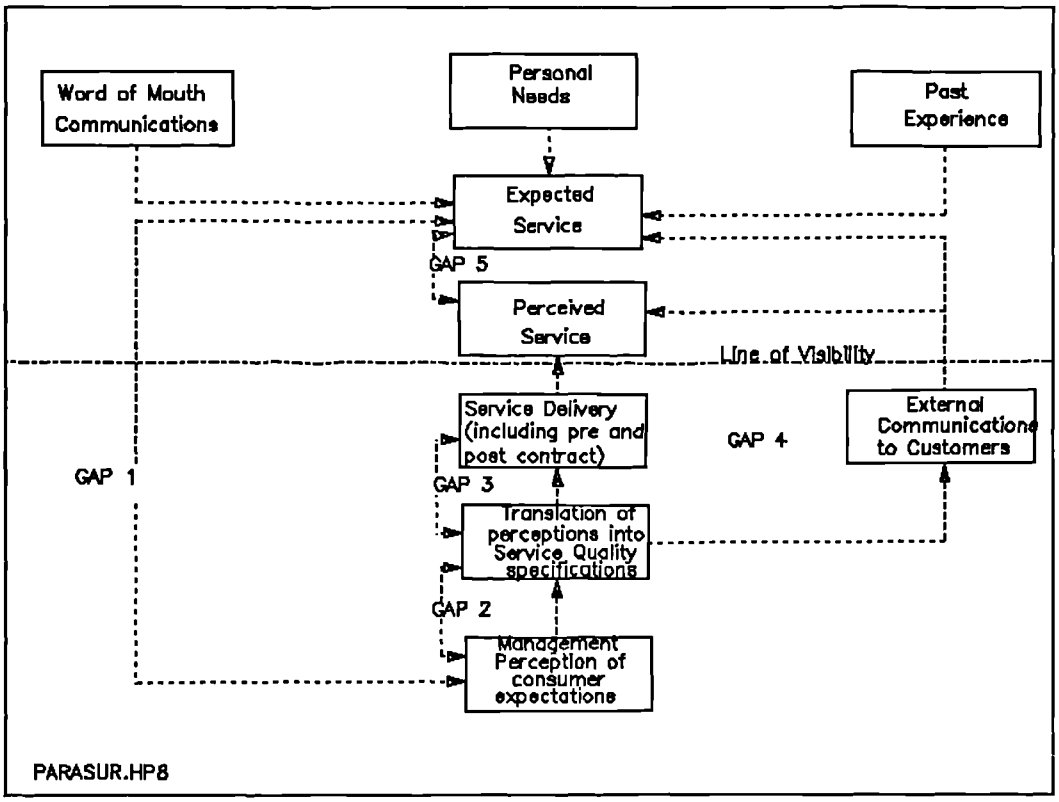


Figure 13.1: **Gap model** Source Parasuraman et al 1985

The top half of the Parasuraman model shows gap 5 as the source of customer satisfaction / dissatisfaction. This gap compares the customer's perception of service received with their own expectations.

However, there is no mirror view of the supplier's perception of service provided. Instead of the supplier's perception of performance they have "service delivery" as an "actual" service delivered. It is possible, and has been evident in this research, that "actual" service delivered differs to suppliers' perceptions of service delivered. It is the supplier's perception of performance which motivates him to improve; if he is unaware of a problem, that problem is unlikely to be rectified.

As misperception of performance has been identified here as being correlated to customer dissatisfaction, this appears to be an important element of the Parasuraman model that is not present.

The simpler mismatch model used in this research gave a more balanced view of gaps, understanding both parties' perceptions of requirements and performance. It was also externally oriented rather than requiring understanding of internal processes. This appears to be more useful, simpler model than Parasuraman et al's which is difficult to apply in practice. It appears to be particularly useful in identifying initial problems in relationships.

Trade-offs

When discussing how different companies give different emphases to each competitive priority, Hayes and Wheelwright (1984) state:

> **"It is difficult (if not impossible) and potentially dangerous for a company to try and compete by offering superior performance along all of these dimensions simultaneously, since it will probably end up second best on each dimension to some other company that devotes more of its resources to developing that competitive advantage"**

This statement uses the term **"superior performance"** and gives the impression of choice between dimensions. However, operations will only have this choice and the ability to provide superior performance once they have achieved adequate performance.

This evokes the Wheelwright & Hayes four stage model as a relevant concept.

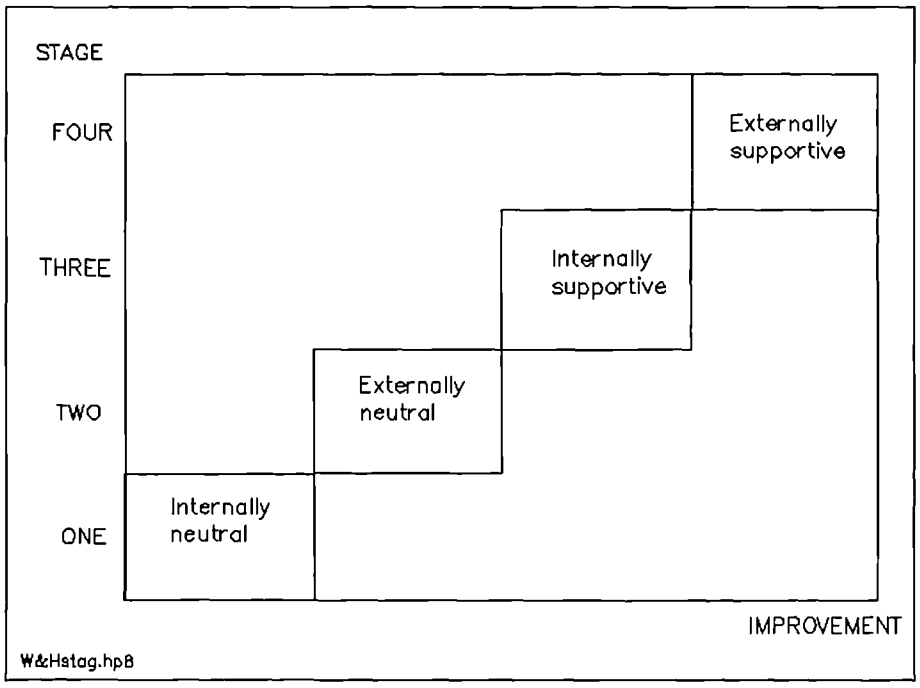


Figure 13.2: **Four stage model** Source, Wheelwright & Hayes 1985

If an operation is **not** achieving adequate performance, it is likely to be at the first or second stage of this model, fighting for neutrality. At these stages, it could be argued that performance measurement is best focused on critical dimensions along which the operation is performing badly; improving performance on these will enable some fires to be put out. It is proposed here that effort spent on finding out customers' requirements for comprehensive, multi-dimensional lists of performance is a waste of time when everyone knows in a relationship that the supplier is appalling on a critical dimension.

On reflection, the suppliers in the sour relationships in the supply chains studied could be viewed as being stage 1 or stage 2 companies. It would be difficult to justify

them spending significant effort on determining customer requirements and customers' perceptions of performance for technical support, for inter-personal relations and other dimensions if they are aware of significant customer dissatisfaction for the critical dimension of delivery speed.

By contrast, the super-fast suppliers in the more harmonious relationships are gaining competitive advantage through superior operations performance and are therefore stage 4 companies.

This echoes the ideas behind Ferdows & De Meyer's (1989) sandcone model of getting one dimension right at a time before shifting improvement effort onto others.

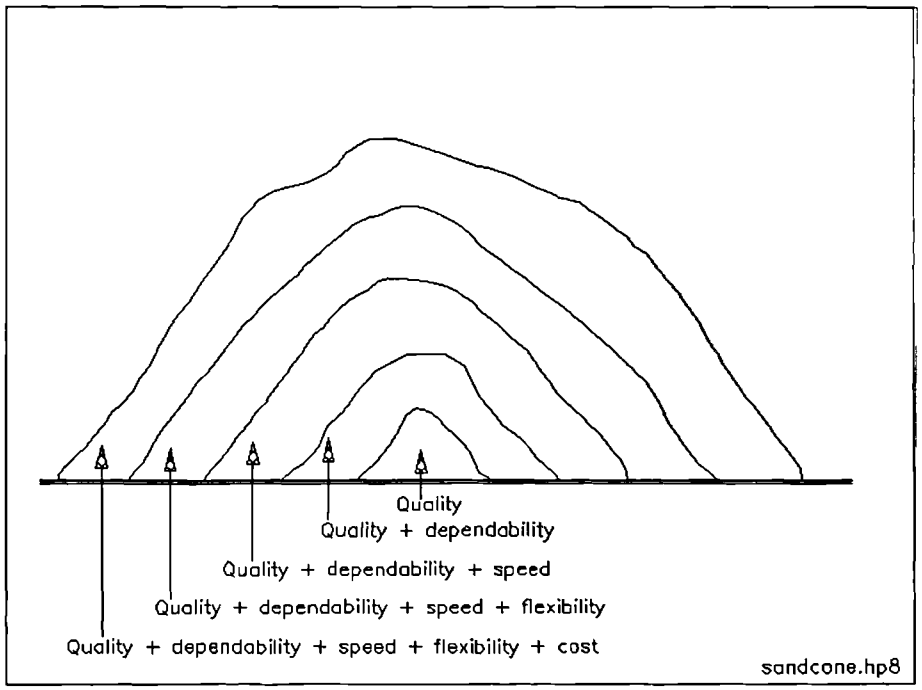


Figure 13.3: **Sandcone model** Original source Ferdows & De Meyer (1989)

Stage 1 and 2 supply chain relationships are likely to be at the core of the sandcone, with fundamental performance problems. Stage 3 and 4 players are likely to be further out in the sandcone and able to use their performance to compete in the market.

If operations management is going to broaden its concepts to embrace supply chain management, concepts like the sandcone model would need rethinking for a supply chain. It is widely recognised that quality should be at the core of the sandcone in manufacturing but delivery speed or delivery reliability are likely to be at the core of distribution.

Position in the Chain

Operations management has paid little attention to date on the implications of position in chain. Hayes & Wheelwright (1984) identified the implications of a manufacturer's position in the supply chain relating to (i) demand volatility, (ii) asset intensity, (iii) profitability, (iv) technological change and (v) scale and balance. There is little evidence of research to test these views in the area of operations management. They also represent a limited set of factors out of possible list of variables which could alter with position in chain. This research took a more behavioural, performance oriented approach and proved that customer dissatisfaction and misperceptions of performance alter

with position in the chain. The scope for further research here is vast.

The perspective above of position in chain is more of passive observation about what is likely to be different, depending on chain position. More active and strategic is the identification in this research of the determination of supply chain roles and responsibilities. This raises a large number of research questions, including:

Should networks be focussed to limit chain players potential conflicts arising from differing roles and responsibilities in different chains?

Will internal conflicts arise in operations because of conflict in chain role and responsibility and firm objectives? Is so, how should these be resolved?

The list of potential research questions is vast, because of the newness of the subject and its strategic implications.

Supply Chain Management - An integrating concept

The literatures relevant to operations management are currently separate and focus on different things. Production management has historically tended to look inwards to its operation and, more recently with the development of manufacturing strategy and operations management, outwards towards its immediate customer.

Purchasing management has looked backwards to its suppliers. Service management has tended to look outwards to the consumer.

It is interesting to observe the location in the supply chain of these different literatures when they have considered performance measurement. It is also interesting to observe the dimensions of performance which have been considered. This is shown below in figure 13.4:

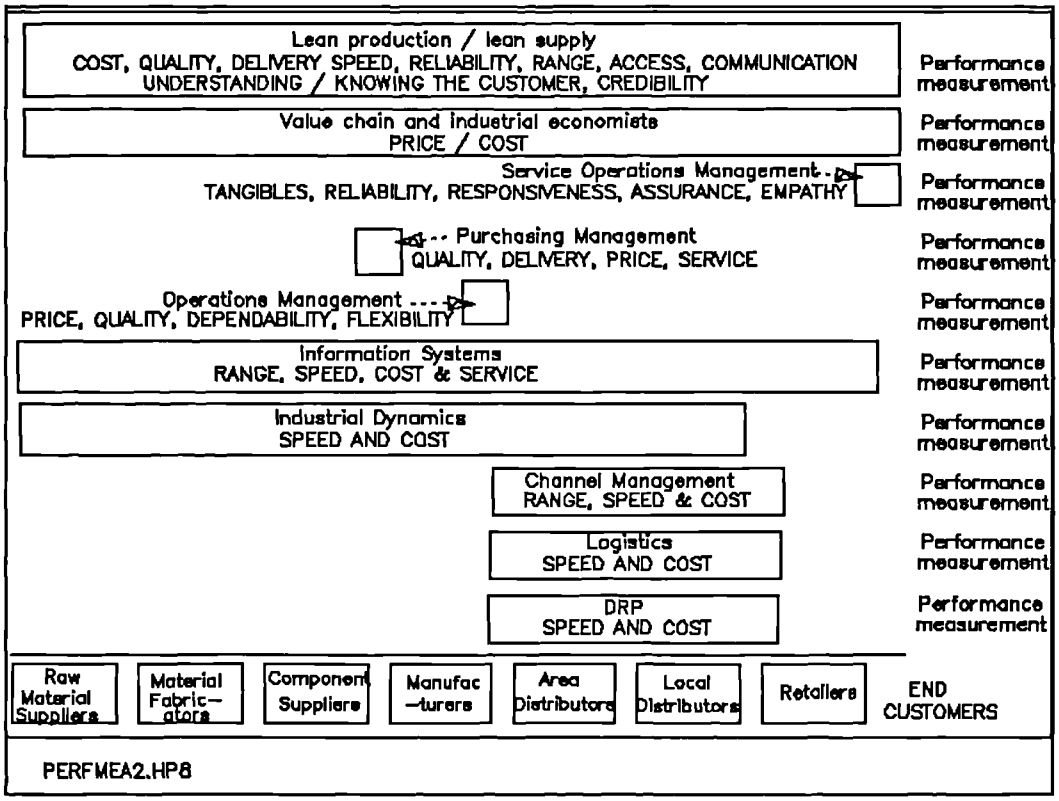


Figure 13.4: A reflection on the disparate literatures

As can be seen, much of the literature - notably DRP, logistics and industrial dynamics - have focused attention primarily on the dimensions of delivery speed

and cost. Operations Management and Purchasing Management have used a broader set of dimensions but these have tended to be constrained to hard variables and have been applied to a fairly limited part of the supply chain. The service management literature has adopted a broader set of customer oriented dimensions of service quality but have pre-dominantly concentrated on relations with consumers of services.

The lean production / lean supply work of Womack et al (1990), Lamming (1987, 1989 and 1993) and Nishiguchi (1987 and 1994) have discussed a broad set of performance dimensions associated with the entire supply chain. This holistic core of work, coupled with this contribution to supply chain management should provide the foundations for integration.

Scope for further work

It was identified in the literature that intermediate relationships between the polar extremes of vertical integration and market are increasing in popularity. These co-operative relationships may require more people centred, interpretive research.

The work beyond this could develop the ideas using more in depth case studies and action research as indicated in Galliers (1991) proposed stages for research

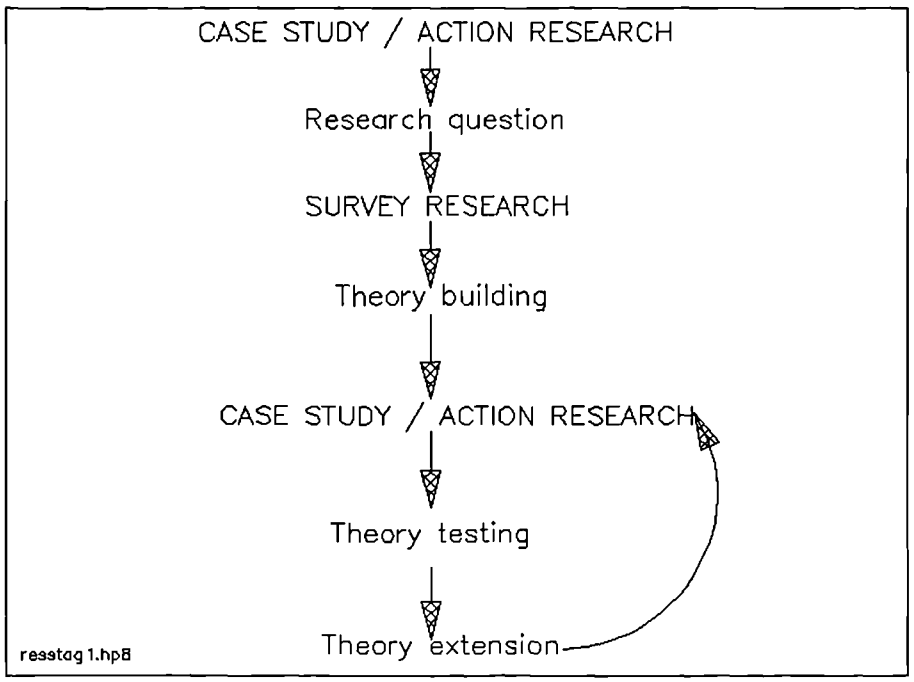


Figure 13.5: Galliers (1991) proposed stages for research

More importantly, though, conceptual work is required that develops frameworks and formulates the concept of supply chain management more clearly i.e. more work is required on theory building prior to moving on to case studies of action research. Currently we have no conceptual frameworks to help characterise and categorise supply chains. These should necessarily allow differentiation between aspects of supply chains including industry, product / service, process, relative size and power of players, network breadth, focus and performance dimension priorities.

In particular, much of the research to date has been in the automotive industry. The chains in this industry typically have their supply chain managers at the

assembler, calling the tunes upstream through component supply and downstream through the dealer network.

CONCLUSIONS

This piece of research is a contribution to a potentially vast and strategically significant field of operations management.

It provided results that are meaningful, relevant, and operationally valid to the Case Company. The work is innovative in both its more behavioural approach. The approach and the findings help to understand relationships in supply chains and the role of players in those relationships.

Beyond this work, many potential avenues for further research have been opened.

CHAPTER 14 - IMPLICATIONS FOR OPERATIONS MANAGERS

SUMMARY

This final chapter proposes implications of the work for Operations Managers.

The importance of Operations Managers identifying their customers' perceptions of performance is highlighted. Also, it is stressed that this should be compared to their own perceptions of performance. Any difference between the two should be examined to identify if a real performance problem exists or if customers require education to alter their perception of a performance gap.

The research clearly identifies a link between misperception of performance and customer dissatisfaction. An example of the power of focusing the business on specific operational performance measures is provided.

The significance of the delivery dimension is highlighted in this particular operations environment. More generalisable if the message of focus on a critical performance dimension.

It is concluded in this chapter that the effect of position in the supply chain requires further investigation before a generalised view for Operations Managers can be expressed. It is recommended, therefore, that this work be repeated in other different types of supply chains before the implications for Operations Managers of position in chain can be asserted.

INTRODUCTION

The previous chapter discussed the implications of this research for operations management and supply chain management theory. This chapter considers the implications of the work for practising Operations Managers.

Firstly it considers the significance of the finding that suppliers' perceptions of a performance gap differs significantly from customers' perceptions.

SUPPLIERS' AND CUSTOMERS' VIEWS OF A PERFORMANCE GAP

It has been shown in this research that the customers' views of a performance gap were significantly worse than the suppliers' views. It was also shown that the difference in views on performance was linked to customer dissatisfaction whereas the difference in views on requirements was not. There are many implications of this for Operations Managers.

Firstly, it is possible that the supplier's operation is deluding itself about its performance and that problems exist which it is not aware of. In this situation, the Operations Manager in the supplier should gain as much detail of performance information from the customer and actively use that information to (i) focus attention on the right part of their operation (ii) set up performance measures to gain control of that part (iii) implement

improvement initiatives to change performance (iv) communicate this active desire to change and subsequent improvement to the customer.

Secondly, it is possible that there is not a problem with the supplier's performance but that the customer wrongly **perceives** a problem. In this situation, the implications for the Operations Manager in the supplier is to establish a dialogue with the customer on performance, and provide convincing and comprehensive performance data to persuade the customer that their perception is not correct. This is a very different situation to the first.

This research has highlighted that, for both these situations, Operations Managers should focus attention on finding out their customers' views of the performance gap to identify if it differs from their own. This would require a communication process with customers to perform this; currently many Operations Managers are detached from customers and rely on sales and marketing contacts to provide them with feedback. However, this feedback is not usually focused on operational performance issues. Therefore, new processes would be required in businesses to facilitate this.

Currently only one relationship considered in this research - the INS/LD relationship in the Spanish braking chain - appeared to have a communication process for understanding performance in the dyads. This was pre-

dominantly a people process involving the sales representatives liaising with the customers. The representatives reported problems regularly at a weekly management meeting, then the senior managers, including the Managing Director, took personal interest and also liaised with the customer. The culture of the local distributor's business was an open door to the M.D. at any time for staff, customers and suppliers. The M.D. had a small office which could be used for private meetings but he showed a tendency not to be desk bound, apparently spending most of his time talking to, or visiting customers. The discussions witnessed in this business were very much a "can I help you" process orientation, in sharp contrast to the wingeing, blaming, operations orientation of many of the other companies, notably upstream in the supply chain.

The effect of this people centred approach to the relationship was startling and clearly very different to the other relationships studied. The installers' views demonstrated this was no pretence - genuine friendships had formed in the relationships, not only with the sales representatives. This local distributor operated a counter operation, as did many others. The different approach was evident in terms of the informality witnessed over counter sales. The counter was low and provided good visibility for the customer to the back office. Continuous conversations were going on between

visiting customers and the staff but the level of apparent work activity and efficiency remained high.

This relationship is a good example for senior managers to look. Customer service and communication were the core of the supplier's operation right up to the level of the Managing Director. This research does indicate that different, customer oriented business processes are likely to be required in businesses where a substantial difference exists between the supplier's view of performance and that of their customers.

MISPERCEPTION OF PERFORMANCE AFFECTS CUSTOMER DISSATISFACTION

It was identified in this research that misperception of performance was related to customer dissatisfaction but misperception of requirements was not. This does not imply that companies should abandon marketing activities that try to establish what customers want. However, it does elevate the importance of companies finding out what customers perceive their operational performance to be.

A powerful example of the effect of improved communication about performance is evident in the relationship between one of the Case Company's braking systems manufacturing plants and its sister aftermarket customer. The customer had complained bitterly about performance for many years until the managing director persuaded the group automotive director to implement

performance measurements on delivery reliability. Monitoring of delivery reliability was elevated to a group board activity with performance improvement graphs being discussed at regular board meetings.

Within 2 months of implementation the graphs showing arrears in deliveries to the aftermarket looked like ski-slopes. It was generally accepted in this business that the fact that this dimension had been highlighted by senior management as being important, coupled with a high profile measurement process, that these had both caused a concerted, focused effort to improve on that dimension.

This senior level focus on measuring and reviewing operational performance in addition to financial performance appears fundamental. It is common sense that, if senior managers want improved operational performance, their intent must be visible in the business and to their customers. Performance measures which are well communicated provide this visibility.

SIGNIFICANCE OF THE DELIVERY DIMENSION

Aftermarket supply chains have, over time, adapted to their end customers' (the installers') requirements, particularly for quicker delivery speed, usually within an hour. These end customer requirements are likely to relate to:

(i) The increasing tendency for consumers (car owners) to want their vehicles repaired and returned the same day, even though the full diagnosis of parts required for this repair or service is not made in advance.

(ii) The increasing variety in the car parc in terms of the proliferation of makes and models available, contributing to the reluctance and inability of the installer to carry stock to cover the parc.

(iii) The increasing business awareness of the installers regarding inventory management, contributing to their reluctance to carry stock

Distributors appear to have adapted to these requirements by:

(i) Carrying a wide range of parts

(ii) Carrying enough inventory of each of these parts to provide high availability, then replenishing used inventory. (Inventory turns in players in these supply chains were as low as 4 times a year, compared to world class performing distributors in other industries reputedly turning inventory 17 - 35 times a year)

(iii) Efficient sales order processing, picking and delivering in batches of 1, particularly at the local distributor

(iv) Innovative rapid forms of delivery transport adapting to cities' traffic problems, notably motor scooters (at local distributors) and roving warehouses (ranging from vans at local distributors to articulated HGVs at area distributors)

However, these adaptations do not appear to be keeping pace in satisfying customers' demands for quicker delivery speed or higher availability. It does appear, however, that the super-fast suppliers (such as the local distributor in the Spanish braking chain) can significantly reduce customer dissatisfaction by performing well against this key variable. Therefore, it does appear possible to satisfy customers against this critical dimension in these supply chains. However, most of the businesses in these chains need to increase their rate of improvement.

This research highlights the importance for Operations Managers to identify clearly and focus on a critical dimension. This should not imply that operational performance in other areas is allowed to slip but rather

that a simple, focused effort on a particular dimension is important.

POSITION IN CHAIN

In these supply chains, evidence was provided of increasing customer dissatisfaction and misperception upstream. The mismatches of perceptions between the area distributors and the component manufacturers painted a rich picture of sour, hostile relationships, within which the area distributors felt their needs were second place to the vehicle assemblers.

This research result cannot be viewed generically by Operations Managers as proving that all upstream businesses in supply chains are more likely to exhibit greater customer dissatisfaction and greater misperception. Rather, it is possible that this effect is specific to the context of these chains.

Figure 14.1 below shows the position of the component manufacturer supplying both the original equipment chains on the left of the figure and the aftermarket chains on the right.

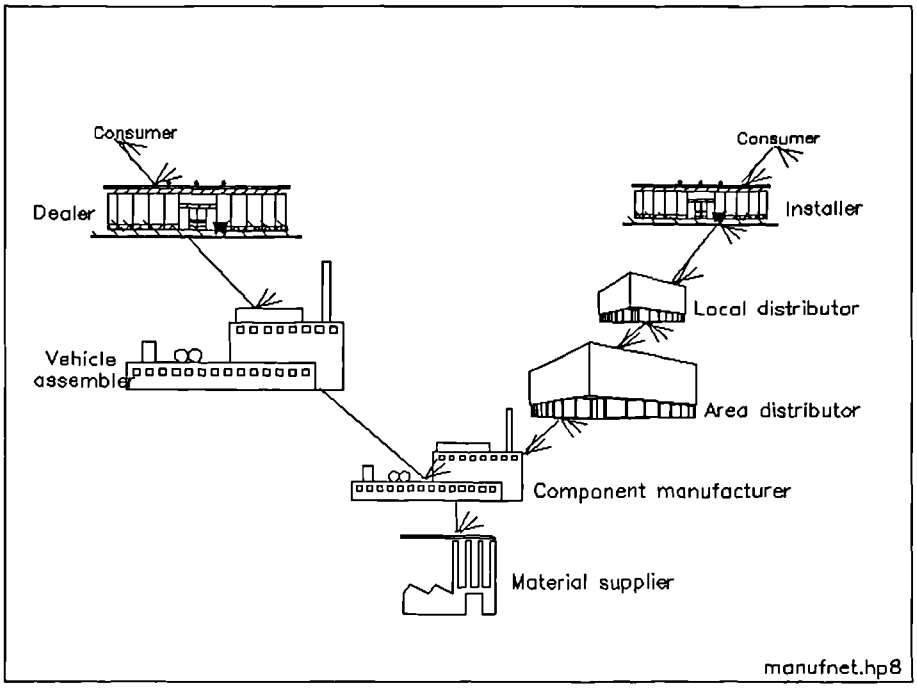


Figure 14.1: Component manufacturer's position in the network

Five to ten years ago the overriding requirements of the vehicle assemblers were quality and price; this provided a sharp contrast of needs to the aftermarket who wanted delivery and service. In this situation, one could feel great sympathy for the operations manager of the component manufacturer who, to satisfy both markets from one plant would feel torn down the middle. At this time the component manufacturers responded to the demands of the vehicle assemblers and placed their requirements over the aftermarket in their priorities.

However, times have changed since then in many respects. Firstly, many of the manufacturers' margins to the vehicle assemblers have been screwed down to negligible levels. In many instances they manufacture components at

a loss but survive because of profits on their aftermarket sales; this is certainly true of the Case Company. One would think that this should raise the importance of satisfying the aftermarket chains' requirements. The qualitative analysis suggests this is not the case.

Secondly, the vehicle assemblers have increasingly moved towards JIT supply, making delivery speed, delivery flexibility and service aspects of the relationships with the component manufacturers of paramount importance. One would think from this that the increased focus on delivery and service would also benefit the aftermarket chains. These benefits do not appear to be being enjoyed within the supply chains studied; the aftermarket are still very much the poor relation to the vehicle assemblers. In the AD/M relationship of the UK electrical chain, the manufacturer condemned the aftermarket area distributor for having volatile schedules (which they did not satisfy) whilst openly admitting to allowing greater flexibility to the vehicle assemblers on an hourly basis.

Certainly the research did prove that, in these supply chains, customer dissatisfaction and misperception of performance increased with increasing position in the supply chain. Possible reasons for this are not obvious. Size of business did not uniformly increase upstream. Whilst some chains went from large manufacturers down to medium and small to medium distributors to small

installers, some of the manufacturers were smaller than the area distributor. Some of the satisfied installers were quite large businesses.

On reflection, it appears that a company culture difference is the most likely cause. Upstream players were more internally focused, less customer oriented in their cultures. Downstream players appeared not only to be more aware of customers requirements and perceptions of performance but also to **care** more about them.

This implies that Operations Managers in upstream businesses would do well to focus on customer service in terms of education, training and business processes. It appeared in these chains that distribution and retail businesses in supply chains had a more customer oriented culture.

SUPPLY CHAIN PERFORMANCE ROLES

Managing a supply chain must necessarily involve managing the relationships within it. Understanding customer requirements / performance gap in each relationships would help to identify roles and responsibilities of chain players and to design appropriate measures of performance.

chrole1.hp8

REQUIRED ROLES IN UK BRAKING CHAIN

	MANUFACTURER	AREA DISTRIBUTOR	LOCAL DISTRIBUTOR
QUALITY	Manufacture OE or good brand. Provide warranty. Durability within warranty period. Packaging quality.	Good known brands Low level of warranty returns	OE brands. Warranties
DELIVERY	Quick response to schedule changes. Lead time down from 6 mths.	Delivery once a week 95% plus availability Fixed delivery window	80% deliveries < 1 hour 30% < 30 minutes Urgent deliveries in 5–10 minutes
SERVICE	Efficient SOP to allow quick changes to schedule	Provide technical support. Visits by reps. EDI link	No reps. visits. Frequent small orders by phone. Quick parts information.
RANGE	Wider range	Range depth, not breadth.	Wide range. One stop shopping Greater access to new parts
PRICE			Good prices

Figure 14.2: Roles in a supply chain

There was little evidence in these supply chains that the operations had considered their role in terms of end customer satisfaction. Indeed, many businesses had not even identified who their end customers were. If businesses are seen to gain competitive advantage by focusing on end customers and driving the chain to satisfy them, it will be an increasingly important operations management task to identify the role that each business has in ensuring that the end customer's business is won and kept.

Extending the ideas of supply chain roles to performance measurement enables responsibilities of each chain player

for their contribution to end customer satisfaction to be recognised. The nature of differing roles in supply chains leads to differing performance responsibilities. Obviously, most product quality responsibility rests with a manufacturer, though intermediaries could damage the product through poor handling or storage. Most service received and perceived by the end customer is provided by their immediate supplier, however, technical support often by-passes this route, coming from a manufacturer. Range responsibilities would vary with the nature of the market. In the supply chains studied in this research the an individual manufacturer provided limited parts of the aftermarket range and the area distributor buffered the supply chain's range requirements.

Price responsibilities will also vary between chains. In these chains the area distributors took most of the decisions on pricing structures for the rest of the chain.

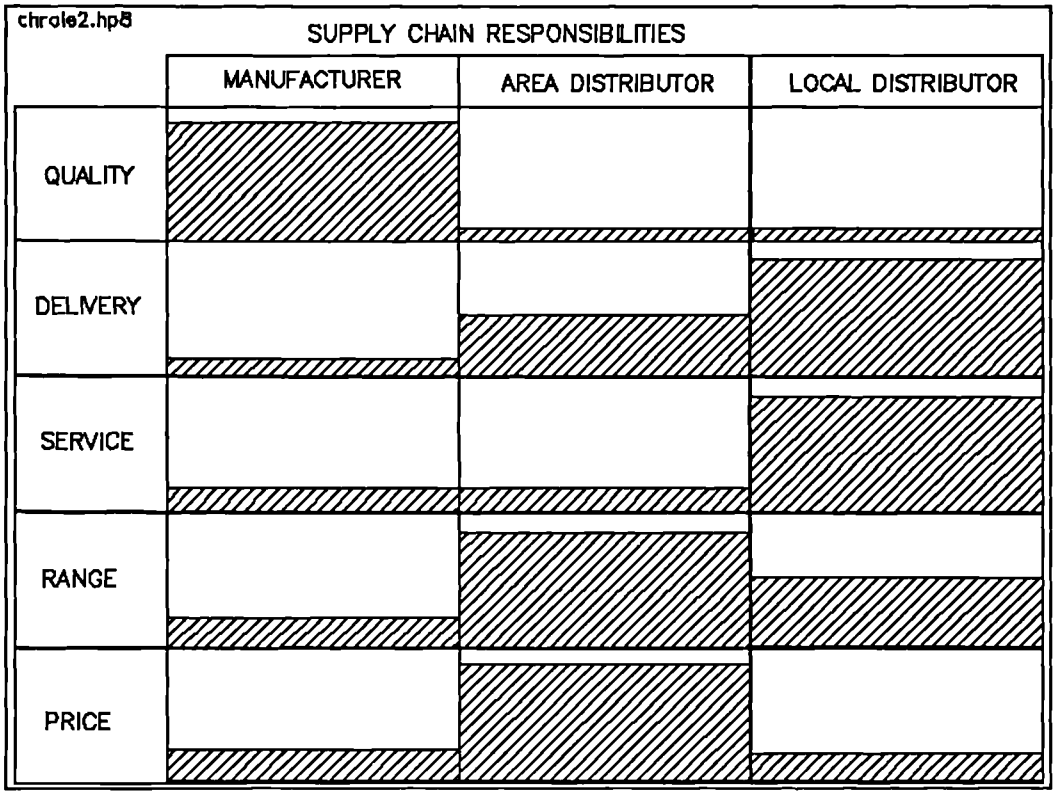


Figure 14.3: Example of significance of responsibility and performance contribution in the supply chain

This work implies that Operations Managers, particularly those who wish to manage the supply chain, should clearly identify these responsibilities and communicate to the other chain players.

CONCLUSIONS

Businesses have tended to focus more effort on establishing what customers want than they have on finding out (i) how customers view their performance and (ii) how this differs from their own view of their performance. This research has identified a critical link between differences in perceptions of performance in relationships and customer dissatisfaction.

This implies that Operations Managers should investigate if this gap in perception exists in their business and if it appears to be linked to their customers' dissatisfaction.

Operations Managers have tended to focus on hard, tangible aspects of performance. It can be concluded from this research that Operations Managers should consider these less tangible, perceptions of performance in addition to their own internal view of performance.

This research has contributed more evidence to support that position in a supply chain may effect the operation. This highlights that Operations Managers should consider position in chain, not only when examining their own operation but also when comparing or benchmarking it to others.

This research has identified that each link in a supply chain has a role and a responsibility which is critical to end customer satisfaction. Supply chain managers should identify these roles and responsibilities in the chains they wish to manage.

The results of this work should be viewed by Operations Managers as suggesting consideration of certain aspects rather than prescribing good and bad practice. The work requires replicating in other chains of different types

before it can be considered as generically applicable to all Operations Managers.

Therefore, work is required in other supply chains. Chains for food / grocery, fashion and capital equipment are likely to be structured differently and to exhibit different behaviour. Little evidence of research in them is apparent to date. This work has highlights the need for further research in these different types of chains.

APPENDIX 1.1

UK BRAKING CHAIN - BRIEF COMPANY PROFILES

Interviews took place in 10 installers, 1 local distributor, 1 area distributor and 1 factory all located in the UK. These are referred to as Installers 1-10, Local Distributor 1, Area Distributor 1 and Manufacturer 1. Their approximate locations are shown on the map below.

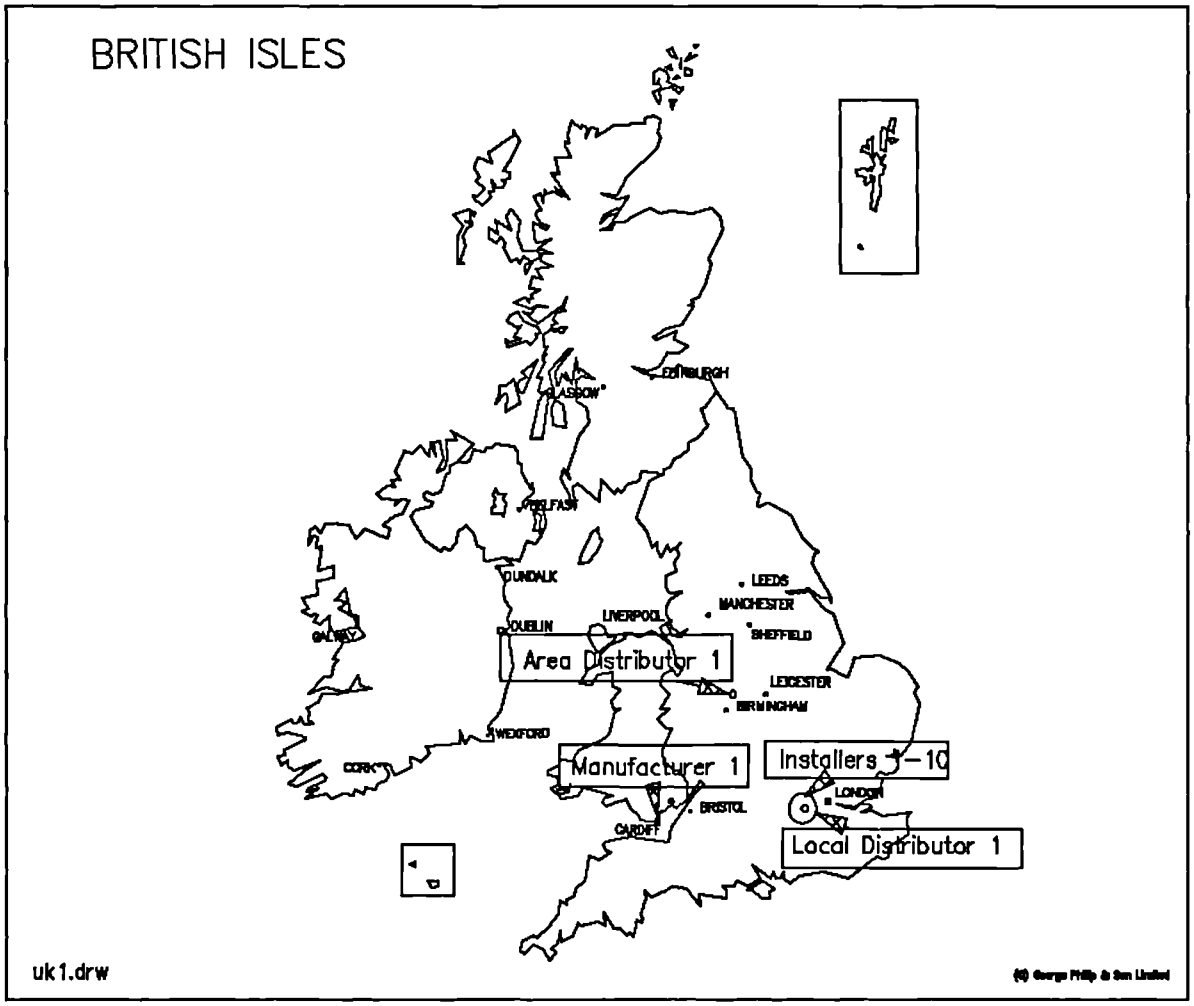


Figure A1.1: Location of UK braking chain players

INSTALLERS 1-10

Interviewees:

10 proprietors

All 10 installers interviewed were located in the South East of England within 20 minutes journey time from the Local Distributor. They included 2 Fast Fit operators, 7 independent garages and 1 Vehicle Manufacturer's agent. They were all small businesses employing between 1 and 10 people. The range of work carried out by different installer types varied. The Fast Fit operators carried out only replacement fit or replacement fit and specialist service only. The independent garages carried out a greater range of work including service, repair, replacement fit, diagnosis, electrical testing and, in 2 cases, body work repair. The VM agent carried out service, repair, replacement fit, diagnosis, electrical testing but not bodywork repair.

LOCAL DISTRIBUTOR 1

Interviewees

- Chairman
- Joint Managing Director
- Sales Manager

Local Distributor 1 was formed in 1980 when the original company was split into 3. Local Distributor 1 quickly

expanded by opening new branches to become the largest independent motor factor in the South East of England

Their main business role is a motor factor.

AREA DISTRIBUTOR 1

Interviewees

- Managing Director
- Information Technology Director
- Director and General Manager, Logistics
- Director and General Manager, Distribution
- Director and General Manager, Parts and Service
- Area Sales Manager, South East
- UK Development Manager
- UK Distribution Centre Manager
- European Materials Manager
- Purchasing Manager
- Management Services Manager

Area Distributor 1 is based in Central England, on an airfield; the operation runs out of aircraft hangers. They provide 2 main services - (i) packing the product into a saleable form and (ii) delivering it.

MANUFACTURER 1

Interviewees

Managing Director

Factory Manager

Manufacturing Manager

Materials Manager

Quality Manager

Manufacturer 1 is a braking systems manufacturer located in South Wales, UK. They manufacture hose products for OE customers including Nissan and Ford, heavy duty braking for OE and for Aftermarket and passenger car wheel cylinders.

SPANISH BRAKING CHAIN - BRIEF COMPANY PROFILES

Interviews took place in 10 installers, 1 local distributor, 1 area distributor and 1 Manufacturer all located in Spain.

Their approximate locations are shown on the map below:

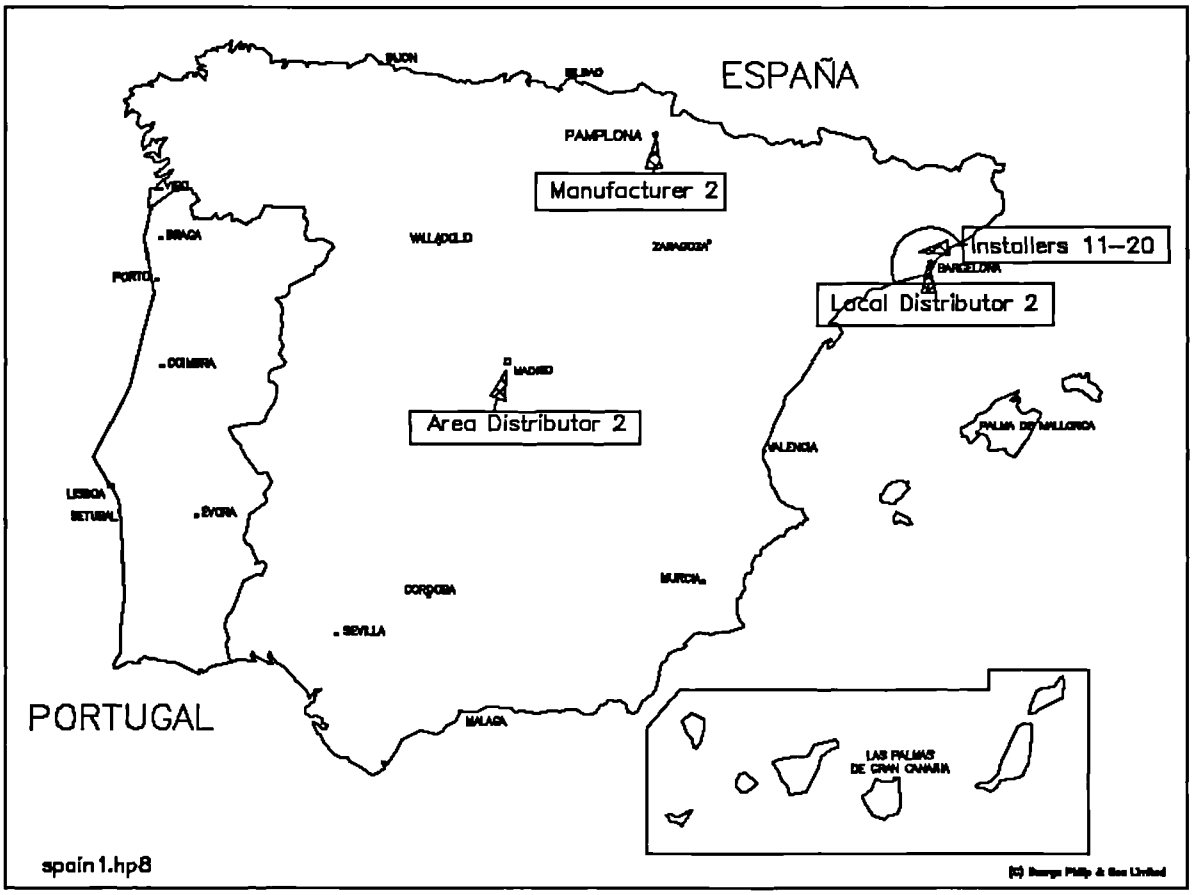


Figure A 1.2 Location of Spanish braking chain players

INSTALLERS 11-20

Interviewees:

10 proprietors / directors

All 10 installers interviewed were located in and around Barcelona in Spain. They included 7 independent garages, 2 vehicle manufacturers agents and 1 specialist repair and service operator. The number of employees averaged under 10 but ranged from 2 to 34.

LOCAL DISTRIBUTOR 2

Interviewees:

Managing Director / owner

Branch Manager

Sales Manager

Local Distributor 2 is a multi-branch distributor with its central branch in Barcelona city centre. It is a private company with all the shares owned by the proprietor.

A central warehouse (mallor) distributes to 6 wholly owned branches, 6 half owned branches and 135 independent shops and smaller distributors (minores). All 6 of the wholly owned branches are in Barcelona within a radius of 25km of the central branch; they serve an area of about 40-50km. 5 of the 50% owned shops are in Barcelona, the

other is in Cerida. The 135 independent shops are spread all over Cataluna.

AREA DISTIBRIBUTOR 2

Interviewees:

General Manager

Personal Secretary to General Manager

Marketing Manager

Zone Sales Manager

Logistics Manager

Supplies Manager

Technical and Franchising Manager

Area Distributor 2 is a multi branch operation with its headquarters at Madrid, Spain. Branches are in Madrid, Seville, Barcelona (sales only) and the Canaries; the Canaries branch is managed separately and receives deliveries direct from manufacturers, rather than going through the Area Distributor. i.e. effectively it acts as the Area Distributor for the Canaries.

There are 130 employees in Spain, 80-85% based at the Madrid headquarters.

Area Distributor 2 currently supports 22 super-distributors.

MANUFACTURER 2

Interviewees:

Director of Quality

Manufacturing Manager

Commercial Director

Purchasing Sub-Director

Manufacturer 2 is an automotive hydraulics manufacturer based in Pamplona, Spain, employing 700, 450 of which work directly in production. It makes calipers, drum brakes, servos, master cylinders, valves and hubs. It is 74% owned by the Case Company and 26% owned by Huarte.

UK ELECTRICAL CHAIN - BRIEF COMPANY PROFILES

Interviews took place in 10 installers, 1 local distributor, 1 area distributor and 1 Manufacturer all located in the UK.

Their approximate locations are shown on the map below:

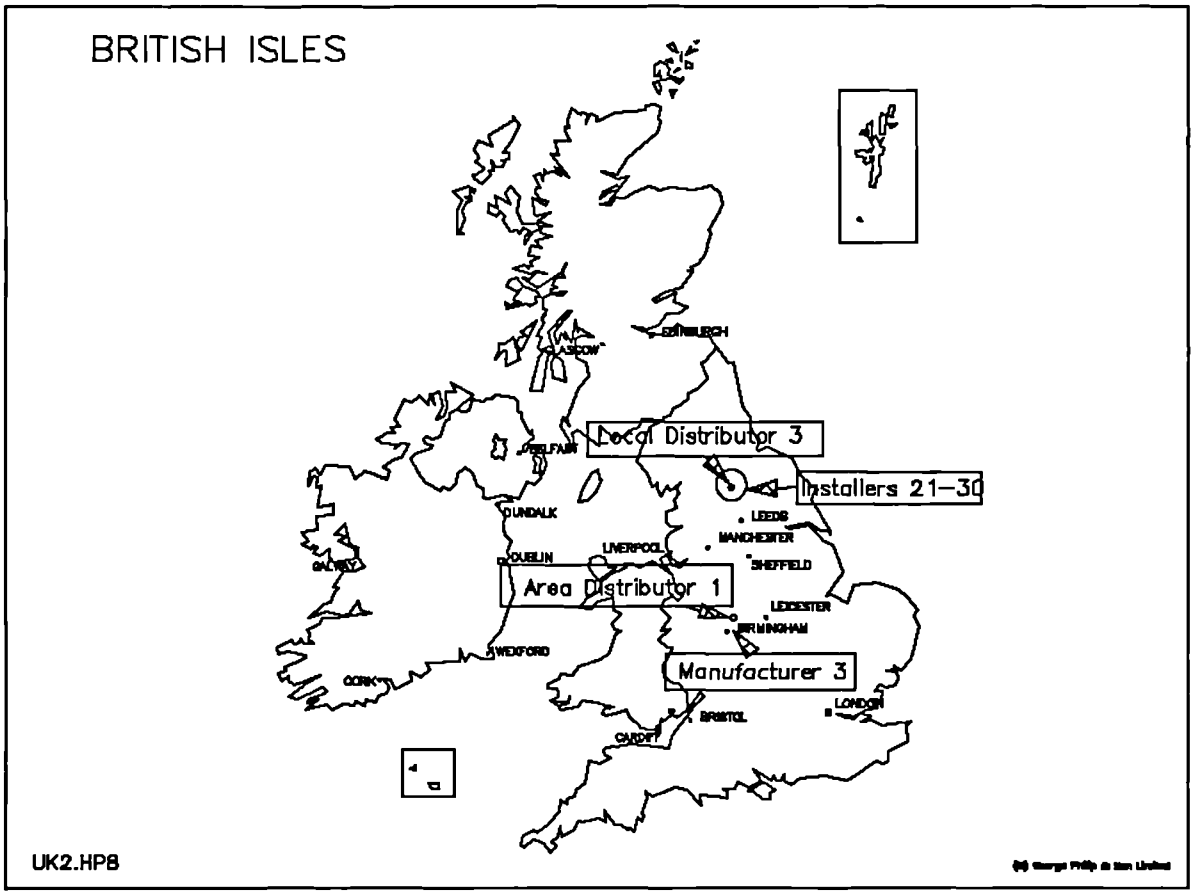


Figure A1.3: Location of UK electrical chain players

INSTALLERS 21-30

Interviewees:

10 proprietors / directors

All 10 installers interviewed were located in and around Rippon in Yorkshire, in the north of England. Barcelona in Spain. They included 7 independent garages, 2 vehicle manufacturers agents and 1 specialist repair and service operator. The number of employees averaged under 11 but ranged from 3 to 35.

LOCAL DISTRIBUTOR 3

Interviewees:

Partner / General Manager

Local Distributor 3 is a single-branch distributor in rural area.

LD3 serves independent garages, vehicle manufacturers agents, agricultural dealers, bus and coach fleet owners, farmers and haulage companies.

AREA DISTRIBUTOR 1

Interviewees

- Managing Director
- Information Technology Director

- Director and General Manager, Logistics
- Director and General Manager, Distribution
- Director and General Manager, Parts and Service
- Area Sales Manager, South East
- UK Development Manager
- UK Distribution Centre Manager
- European Materials Manager
- Purchasing Manager
- Management Services Manager
- Electrical Products Manager

Area Distributor 1 is based in Central England, on an airfield; the operation runs out of aircraft hangers. They provide 2 main services - (i) packing the product into a saleable form and (ii) delivering it.

MANUFACTURER 3

Interviewees:

Operations Manager
Materials Manager
Sales Order Processing Analyst

Manufacturer 3 is a manufacturer of engine management systems including display units, ignition control, auto choke control, vehicle monitoring equipment and vehicle timers. They are based in Birmingham, UK.

SPANISH ELECTRICAL CHAIN - BRIEF COMPANY PROFILES

Interviews took place in 10 installers, 1 local distributor, 1 area distributor in Spain and 1 Manufacturer located in the UK.

Their approximate locations are shown on the map below:

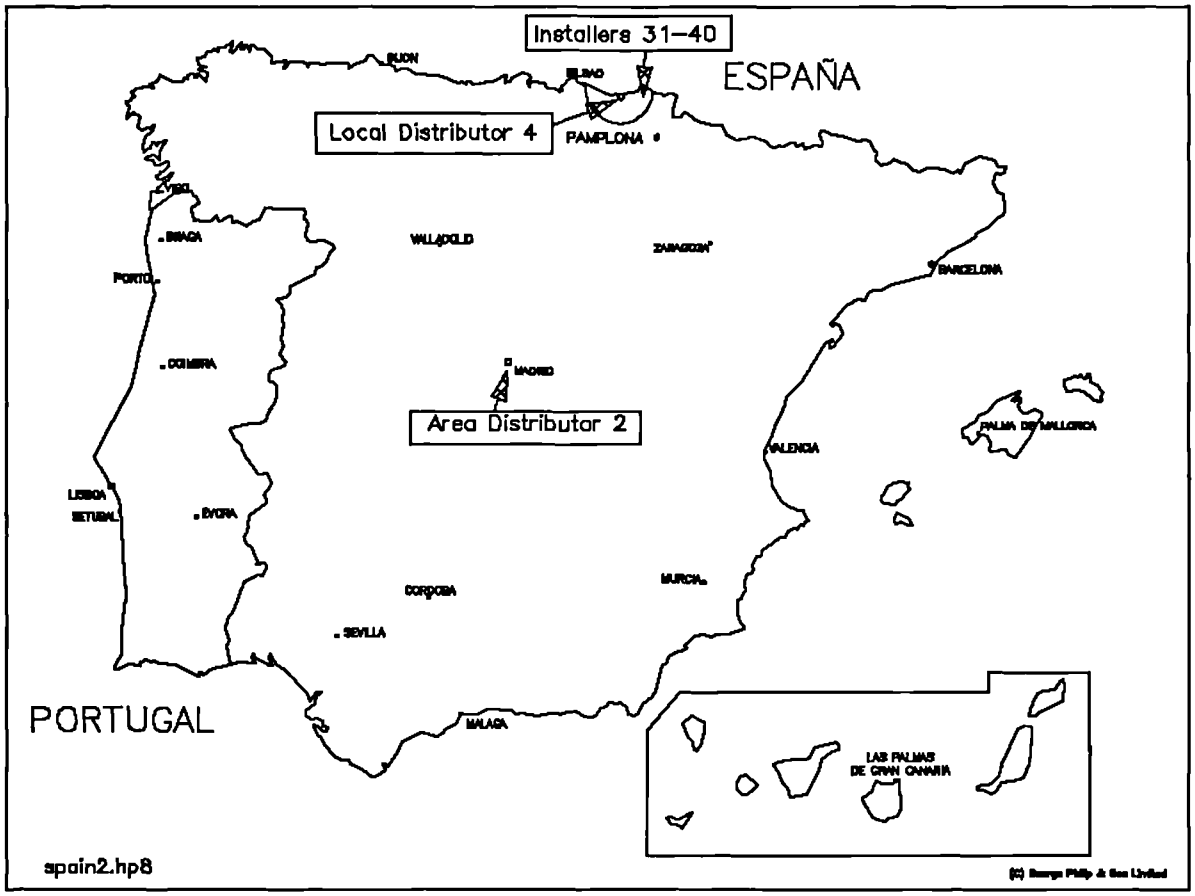


Figure A1.4: Location of Spanish electrical chain players

INSTALLERS 31-40

Interviewees:

10 proprietors / directors

All 10 installers interviewed were located in and around Sans Sebastian in northern Spain. They included 4 independent garages, 3 vehicle manufacturers agents and 3 specialist repair and service operator. The number of employees averaged under 4 but ranged from 2 to 7.

LOCAL DISTRIBUTOR 4

Interviewees:

Owner

Local Distributor 4 is a multi-branch operation of one local distributor, one central warehouse and 7 parts shops. It is located in the centre of Sans Sebastian, a large town on the northern coast of Spain. There are 66 employees in total.

LD4 serves independent garages, vehicle manufacturers agents, specialists, parts shops and local Government with electrical parts.

AREA DISTRIBUTOR 2

Interviewees:

General Manager

Personal Secretary to General Manager

Marketing Manager

Zone Sales Manager

Logistics Manager

Supplies Manager

Technical and Franchising Manager

Area Distributor 2 is a multi branch operation with its headquarters at Madrid, Spain. Branches are in Madrid, Seville, Barcelona (sales only) and the Canaries; the Canaries branch is managed separately and receives deliveries direct from manufacturers, rather than going through the Area Distributor. i.e. effectively it acts as the Area Distributor for the Canaries.

There are 130 employees in Spain, 80-85% based at the Madrid headquarters.

Area Distributor 2 currently supports 22 super-distributors.

MANUFACTURER 4

Interviewees:

Managing Director

Purchasing Manager

Materials Manager

Marketing Manager

APPENDIX 1.4

Manufacturer 4 is a manufacturer of rotating machines such as starters, alternators, dynamos and wiper motors. They remanufacture from old cores which are refurbished. They are based in Birmingham, UK and employ about 600 people.

APPENDIX 2 - EXAMPLE OF MISMATCH TABLE

AREA DISTRIBUTOR'S VIEW OF SERVICE REQUIREMENTS	MANUFACTURER'S VIEW OF SERVICE REQUIREMENTS	*TYPE ONE MISMATCHES*
The Area distributor wants to be able to call off batch quantities each week from the front of the schedule. The Area distributor is happy to commit to materials further ahead but wants short term sales order change capability to meet demand changes.	The Area distributor wants to be able to make schedule changes within lead time	*No mismatch in perception of requirements*
AREA DISTRIBUTOR'S VIEW OF SERVICE PERFORMANCE	**MANUFACTURER'S VIEW OF SERVICE PERFORMANCE**	***TYPE TWO MISMATCHES***
Manufacturer 1 is inflexible. We are a real buggeration to the manufacturer because of the small orders and that's how they treat us. OE customers are given lead times of 2-3 weeks but we are given 18-20 weeks. The managers say we are important customers and should be treated as such but when you go a level below that to the module leaders on the shop, they think we're a pain in the bum and they let us know that. As the managers are measured on output, there's only so far they're prepared to go.	Progress is being made with OE to have electronic scheduling with mutual visibility. Currently there is no electronic visibility of Aftermarket requirements. There are weekly or more frequent meetings with the OE customer but only monthly with the Aftermarket Area distributor to review arrears and look at the forward programme. Aftermarket are every bit as important as other customers.	*The Manufacturer does not explicitly recognise its inflexibility. The Area distributor appears to feel badly treated by the Manufacturer and feels that most of the communication is channelled towards OE supply*

APPENDIX 2 - EXAMPLE OF MISMATCH TABLE

TYPE THREE MISMATCHES	*TYPE FOUR MISMATCHES*
The Area distributor feels that the service performance of the Manufacturer is poor, particularly compared to the service it gives to OE	*No mismatch. The Manufacturer doesn't explicitly admit to a service performance problem and claims the Aftermarket to be as important as OE*

APPENDIX 3 - EXAMPLE MULTIPLE COMPARISON USING TUKEY TEST

	T1	T2	T3	T4
n	60	60	60	60
Mean	1.617	1.9	2.3	1.417
Sum of x	97	114	138	85
Sum of x^2	283	334	452	249
Variance	2.139	1.990	2.281	2.179

Populations Four populations of data, so K = 4

Data Samples of size n_1, n_2, $n_3 \ldots n_K$ from K populations

Degrees of Freedom $V_2 = n_1 + n_2 + n_3 \ldots n_K - K$

Use Studentized tables to find the critical value for V_2 and K values. Call this q.

Calculate:

$$S^2 = \frac{(n_j - 1)}{N - K} S_j^2$$ where $S_j 2$ = variance of the jth sample

and $N = n_1 + n_2 + n_3 + n_4 \ldots n_K$

$$W = \frac{qS}{/n}$$ where $$n = \frac{K}{(1/n_1 + 1/n_2 \ldots 1/n_K)}$$

If W is exceeded by the absolute difference between any pair of sample means, then the corresponding population means differ significantly.

$N = 240$

$K = 4$

$$S^2 = \frac{59\ (2.139 + 1.990 + 2.281 + 2.179)}{240 - 4}$$

$\Rightarrow \quad S^2 = 2.147$

$\Rightarrow \quad S = 1.465$

V_2 = 236 and K = 4

Critical value (q) at 1% level of significance is 4.40

$$W = \frac{4.40 \times 1.465}{/60}$$

=> W = 0.832

Greatest difference in sample means is T3 mean - T4 mean

= 2.3 - 1.417

= 0.883

As this is greater than the critical value q, the difference between these 2 means is significant at the 1% level.

APPENDIX 4.1

STANDARDISED Z SCORES OF T3 FOR CORRELATION WITH T1

	UK BRAKING			SPANISH BRAKIN			UK ELEC			SPANISH ELEC		
	T1	T3	T3*	T1	T3	T3*	T1	T3	T3*	T1	T3	T3*
Q	2	2	0.311	2	1	-0.577	1	1	-0.577	4	1	-0.577
D	3	4	2.087	0	1	-0.577	0	2	0.311	0	2	0.311
S	4	2	0.311	0	0	-1.465	1	0	-1.465	3	3	1.199
R	1	2	0.311	0	3	1.199	3	3	1.199	2	4	2.087
P	0	1	-0.577	0	0	-1.465	3	1	0.577	0	0	-1.465
Q	0	2	-0.342	0	0	-1.86	2	3	0.418	4	4	1.177
D	2	4	1.177	0	2	-0.342	0	3	0.418	0	3	0.418
S	0	4	1.177	2	3	0.418	0	0	-1.86	2	3	0.418
R	4	1	-1.101	2	4	1.177	2	3	0.418	3	3	0.418
P	0	2	-0.342	0	2	-0.342	3	3	0.418	0	0	-1.86
Q	2	2	-0.607	3	0	-2.126	3	0	-2.126	1	4	0.911
D	3	5	1.67	4	4	0.911	2	5	1.67	0	3	0.152
S	0	4	0.911	3	4	0.911	0	5	1.67	4	0	-2.126
R	0	3	0.152	3	3	0.152	3	3	0.152	3	3	0.152
P	0	0	-2.126	2	4	0.911	3	3	0.152	3	1	-1.367

KEY T3* = T3 less the dyadic level effect

T1 vs T3, r = 0.191
T1 vs T3*, r = 0.169

APPENDIX 4.2

STANDARDISED Z SCORES FOR T2 & T3

	UK BRAKING					SPANISH BRAKIN				
	T2	T2*	T2**	T3	T3*	T2	T2*	T2**	T3	T3*
Q	2	-0.731	-1.513	2	0.311	1	1.095	-0.153	1	-0.577
D	4	1.096	-0.152	4	2.087	0	-0.73	-1.513	1	-0.577
S	4	1.096	-0.152	2	0.311	0	-0.73	-1.513	0	-1.465
R	2	-0.731	-1.513	2	0.311	1	1.095	-0.153	3	1.199
P	2	-0.731	-1.513	1	-0.577	0	-0.73	-1.513	0	-1.465
Q	0	-1	-2.112	2	-0.342	1	-1.404	-2.406	0	-1.86
D	0	-1	-2.112	4	1.177	3	0.351	-1.128	2	-0.342
S	2	1	-0.655	4	1.177	3	0.351	-1.128	3	0.418
R	1	0	-1.384	1	-1.101	4	1.228	-0.489	4	1.177
P	2	1	-0.655	2	-0.342	2	-0.526	-1.767	2	-0.342
Q	2	-1.434	-2.985	2	-0.607	3	0.122	-1.804	0	-2.126
D	4	0.956	-1.171	5	1.67	4	0.731	-1.342	4	0.911
S	4	0.956	-1.171	4	0.911	4	0.731	-1.342	4	0.911
R	3	-0.239	-2.078	3	0.152	3	0.122	-1.804	3	0.152
P	3	-0.239	-2.078	0	-2.126	0	-1.704	-3.19	4	0.911

	UK ELECTRIC					SPANISH ELECTR				
	T2	T2*	T2**	T3	T3*	T2	T2*	T2**	T3	T3*
Q	1	0	-0.969	1	-0.577	1	0	-0.969	1	-0.577
D	3	1.633	0.248	2	0.311	0	-0.816	-1.577	2	0.311
S	0	-0.816	-1.577	0	-1.465	3	1.633	0.248	3	1.199
R	0	-0.816	-1.577	3	1.199	0	-0.816	-1.577	4	2.087
P	1	0	-0.969	1	0.577	1	0	-0.969	0	-1.465
Q	2	0.447	-1.058	3	0.418	4	0.923	-0.712	4	1.177
D	0	-1.043	-2.143	3	0.418	3	0.264	-1.192	3	0.418
S	0	-1.043	-2.143	0	-1.86	3	0.264	-1.192	3	0.418
R	2	0.447	-1.058	3	0.418	3	0.264	-1.192	3	0.418
P	3	1.192	0.516	3	0.418	0	-1.714	-2.632	0	-1.86
Q	2	-0.153	-2.013	0	-2.126	1	-0.613	-2.362	4	0.911
D	0	-1.687	-3.177	5	1.67	0	-1.38	-2.944	3	0.152
S	3	0.613	-1.432	5	1.67	3	0.92	-1.199	0	-2.126
R	3	0.613	-1.432	3	0.152	2	0.153	-1.781	3	0.152
P	3	0.613	-1.432	3	0.152	3	0.92	-1.199	1	-1.367

KEY T3* = T3 less the dyadic level effect
T2* = T2 less the dyad effect
T2** = T2* less the dyadic level effect

T2 vs T3 = 0.3325
T2* vs T3 = 0.2452
T2** vs T3* = 0.2243

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